

2
GEOGRAPHIE
DELINEATED FORTH
IN TWO *14*
BOOKES.
CONTAINING

The Sphericall and Topicall parts thereof,

By NATHANAEL CARPENTER, Fellow of
'Exceter Colledge in Oxford.

THE SECOND EDITION CORRECTED.

ECCLESIAST. I.

*One generation commeth, and another goeth, but
the Earth remaineth for ever.*



OXFORD,

Q. M.
Printed by John Lichfield, for Henry Cripps, and are to be sold by
Henry Curteyne. Anno Domini, M. DC. XXXV.

YRABLL 00ADHO
TO
YRABLL 00ADHO

G 1125

C3

Rare. 1st room



TO THE
RIGHT HONOVABLE
WILLIAM,
EARLE OF

PEMBROKE, LORD CHAMBERLAINE

*to the Kings most excellent Maiefty, Knight of
the most Noble Order of the Garter, and
Chancellour of the Vniuersity
of Oxford.*

Right Honourable,



His poore Infant of mine, which
I now offer to *Your Honourable*
acceptance, was consecrated
Yours in the first conception: If
the hasty desire I had to present it,
makes it (as an abortiue brat) seeme vnworthy

THE EPISTLE

my first wishes, and Your fauourable Patronage; impute it (I beseech You) not to *Self-will* but *Duty*; which would rather shew herselfe too *officious*, then *negligent*. What I now dedicate rather to Your *Honour*, then mine owne *Ambition*, I desire no farther to bee accompted *Mine*, then *Your* generous approbation: wishing it no other fate, then either to *dye* with Your Dislike, or *live* with Your Name and Memory. The generall Acclamation of the Learned of this Age, acknowledging with all thankfull Duty, as well Your Loue to *Learning*, as Zeale to *Religion*, hath long since stampt me *Tours*. This arrogant Desire of mine, grounded more on *Your* Heroicke vertues, then my priuate ends, promised mee more in *Your* Honourable Estimation, then some others in Your Greatnesse. The expression of my selfe in these faculties beside my profession, indebted more to Loue, then Ability, setteth my *Ambition* a pitch higher then my Nature. But such is the Magnificent splendour of *Your* Countenance, which may easily lend *Your* poore Seruant so much light as to lead him out of Darknesse; and, as the Sunne reflecting on the baser earth, at once both view and guild his Imperfections. My language

DEDICATORIE.

guage and formality I owe not to the Court, but
Vniuersity; whereof I cannot but expect *Your Ho-*
nour to be an impartiall Vmpier, being a most vi-
gorous *Member* of the one, and the *Head* of the o-
ther Corporation. If these fruites of my *Labours*
purchase so much as *Your Honours* least Approba-
tion, I shall hold my wishes euen accompli-
shed in their ends, and desire only to be thought
so worthy in *Your Honourable* esteeme, as to *live*
and *dye*

*Your Honours in all duty and
seruice to bee commanded*

NATHANAEL CARPENTER.

I have the honor to acknowledge the receipt of your letter of the 10th inst. in relation to the above-mentioned matter. I have the honor to inform you that the same has been forwarded to the proper authorities for their consideration. I am, Sir, very respectfully,
 Yours, very obediently,
 J. M. Smith

1870

WESTERN CARBON

The Analysis of the first Booke.

Principles whereof it consists, to wit, Matter and Forme. Chapter 1.

Elementary: as the conformity of all the parts concurring to the constitution of the Spheare. Chapter 2.

Partiall as the Coition, Direction, Variation, Declination: Chap. 3.

Total: as the Verticity and Revolution: Chap. 4.

Earth it selfe: which are either

Magnetick; which are either

Reall: such as are assigned in respect of the

Heauens: wherein we treat of the Site, Stability, and proportion of the Earth in respect of the Heauens. Chap. 5.

Imaginary: such as are the Circles and Lineaments of the Globe, of whose Inuention and Expression. Chap. 6.

Naturall wherein are to be considered two things: the

Proprieties arising out of them; which againe are either

Artificiall: in the Artificiall Spheare representing the Naturall vnto vs: which is either Common or Magnetick. Chap. 7.

Measure of the Earth, with the diuerse manner of Inuention. Chap. 8.

Simply in themselves, in which sort they are diuided into Zones, Climates, and Parallels. Chap. 9.

In respect of the Inhabitants: which suffer manifold Distinction. Chap. 10.

Spaces considered

Distinction which are either

Distances which are either

Simple: wherein is considered the Longitude & Latitude of places. Chap. 11.

Comparatiue: wherein two places differing either in Longitude or Latitude, or both, are considered. Chap. 12.

Primary, which considers the Terrestriall Spheare either as it is

Sphericall, which is two-fold either

Secondary, which handles such matters in the Spheare as secondarily arise out of the first. Such are

Geography, whole object is the whole earth, is either

Topicall
Libro 2º.

Place this Analysis after the first Epistle.

thing
red t
confid
thereo
whe
Pamph
about
in w
the
of

Spontaneous either as it is

which is
two-fold
cubic

John M. ...

the first, such are
consistently and out-
rigger, 20 ft. and
handed, and in
secondary, which

100

100-1000
 100-1000
 100-1000
 100-1000
 100-1000



OF THE SPECIALL

Contents of each Chapter of the
first Booke according to the
seuerall Theoremes.

C H A P. I.

Of the Terrestriall Globe, the Matter and Forme.

- 1 **I**N the Terrestriall spheare is more Earth then Water. pag. 8
2 The Earth and Water together, make one Spheare. pag. 10

C H A P. II.

Of the Conformity of parts in the constitution
of the Terrestriall Spheare.

- 1 The parts of the terrestriall spheare doe naturally conforme and
dispose themselves, as well to the Production and Generation, as
to the continuance and preservation of it. pag. 14
2 All Earthly bodyes incline and approach to the center as neere
as they can. 16
3 Of two heavy Bodies, striving for the same place, that alwayes
prevaileth, which is heaviest. 22
4 Hence it comes to passe, that the Earth enioyes the lowest place.
the

- the next the Water, and the last the Air. *ibid.*
- 5 The Center of the Earth is not an Attractive, but a mere Respective point. 25.
- 6 The same point is the center of Magnitude, and weight in the Terrestrial sphere. 26
- 7 Every point or center of a weighty body, is moved towards the center of the terrestrial Globe by a right line. 27
- 8 A heavy point moving toward the center, will move faster in the end, then in the beginning. 28
- 9 The motion of a magnitude towards the center, is not merely naturall, but mixt with a violent motion. 29
- 10 The lines wherein the centers of two heavy bodies are moved downwardly, being continued, will meete in the center of the Earth. 31
- 11 Two heavy bodies of the same figure and matter, whether equall or vnequall, will in an equall time, move in an equall space. 32
- 12 The Terrestrial Globe is round and sphericall. 33
- 13 The Rugged and vnequall parts of the Earth, hinder not the sphericall roundnesse of it. 36
- 14 The Water concurring with the Earth in the Globe, is also sphericall. 38

C H A P. I I I.

Of the Partiall Magneticall affections in the sphere of the Earth.

- 1 The Terrestrial sphere is of a magneticall Nature and disposition. *pag. 46*
- 2 The magneticall motion is excited in a small and unperceivable difference of time. 49
- 3 The motive quality is spread spherically through every part of the magneticall body. 49
- 4 The motive quality of the magneticall body, is strongest of all in the poles, in other parts so much the stronger by how much they are situated neere the poles. 50
- 5 Magneticall bodies move not uncertainly, but have their motions directed and conformed to certaine bounds. 52
- 6 The

- 6 *The Magnet communicates his vertue to iron or Steele, if it be touched with it.* 55
- 7 *The Magneticall Coition is strongest of all in the poles.* 56
- 8 *The South part of the Loadstone turnes to the North, and the North to the South.* 57
- 9 *The contrary motion in magnets is the iust Conflux and Conformity of such bodies to magneticall vniō.* 59
- 10 *If any part southward of the magneticall body be torne away or diminished, so much shall also be diminished of the North part.* 50
- 11 *The Magneticall variation hath no certaine Poles in the terrestriall Globe.* 63
- 12 *The point of Variation, as of Direction, is onely Respective not attractive.* 65
- 13 *The variation of euery place is constant not variable.* 66
- 14 *The variation is greater in places neere the poles.* *ibid.*
- 15 *The magneticall Declination is answerable to the Latitude, not in equality of degrees, but in proportion.* 69
- 16 *The magneticall declination is caused, not of the attractive, but of the Disponent and Conuersiue vertue of the Earth.* 70
- 17 *The Magneticall Declination hath a variation.* 71

C H A P. IV.

Of the totall Motions Magneticall.

- 1 *The spheare of the Earth by her magneticall vigour, is most firmly seated on her Axell, whose ends or poles respect alwayes the same points in the Heauens without alteration.* 72
- 2 *It is probable, that the terrestriall Globe hath a circular Motion.* 76

C H A P. V.

Of the site, Stability, and Proportion of the Earth in respect of the Heauens.

- 1 *The terrestriall Globe is the center of the whole world.* 99
- 2 *The position of the Earth in the center of the world may bee reconciled,*

conciled, as well with the diurnall motion of the Earth, as the Apparences of the Heauens. 110

- 3 The Earth is firmly seated and settled in her proper place. 115
- 4 The Earthly Globe compared in quantity with the Firmament, & supreme orbes of the Planets, hath no sensible magnitude. 118
- 5 The terrestriall Globe compared with the inferiour Orbes hath a sensible magnitude. 121

CHAP. VI.

Of the circles of the Terrestriall Spheare

- 1 A circle though imaginary in it selfe, hath his ground in the nature of the terrestriall spheare. 122
- 2 The distinction of a circle into a certaine number of parts hath no certaine ground in the nature of the terrestriall spheare, but onely in conueniency. 124
- 3 By Astronomickall obseruation to find out the Meridian. 127
- 4 To find out the Meridian magnetically. 129
- 5 By the Incision of a tree, the Meridian may be found out. 131
- 6 The Meridian being found to find out the Equatour. 137
- 7 Without the helpe of the Meridian to find out the Equatour. 138
- 8 To find out the Equatour magnetically. 138
- 9 The Equatour is an vnmoueable circle, whose Poles neuer vary from the Fixt-Poles of the Earth. 140
- 10 How to know the number of degrees in a lesser circle answerable to the greater. 147
- 11 The sensible and Rationall Horizon in the Earth, are much different: in respect of the Firmament all one. 151
- 12 The sensible Horizon may be greater or lesse, according to the Nature and Disposition of the place. 153
- 13 the Eye may be so placed on the Earth, as it may behold the whole Hemisphære of the Heauens, and yet no part of the terrestriall spheare. 154
- 14 From the Horizontall circle is reckoned the Elevation of the Pole in any place assigned. 155
- 15 How to finde out the Horizon for any place assigned. 156
- 16 How

- 16 How to finde out the Horizontall plaine.
17 The distinction of Horizons.

157
ibid.

CHAP. VII.

Of the Artificiall Representation of the Terrestrial Sphere.

- 1 Of the parts whereof the Globe is Geographically compounded. 163
2 The use of the Artificiall Globe is to expresse the parts of the Earth, so farre forth as they haue a diuerse situation, as well one in respect of the other, as the Heauens. 166
3 Of the direction of the artificiall Globe. ibid.
4 Of the ground and fabricke of the Artificiall plaine Chart. 168
5 Of the ground and fabricke of the Geographicall Planisphaeres with their seuerall distinctions. 175
6 Of the magnetick Terrella. 182

CHAP. VIII.

Of the measure of the Earth.

- 1 The common measures by which the quantity of the Earth is knowne, are miles, and furlongs. 187
2 Of the inuention of the circumference of the Earth. 188
3 By the eleuation of the Pole, or obseruation of an Eclipse or some knowne starre the circuite of the Earth may be knowne. 189
4 By obseruation of the noone-shadōwes the measure of the earth may be found out. 190
5 The opinions of Cosmographers concerning the measure of the Earth are diuerse, which is chiefly to bee imputed to their error in obseruing the distances of places experimentally, according to Miles, Furlongs, and such like measures. 192
6 How by the knowne height of some mountaine the diameter of the Earth may be found out. 197
7 How to finde out the plaine and conuey superficies of the Earth. 198
8 Of

8 Of the number of square miles contained in the Earth. 200

C H A P. IX.

III. P. A. H. C.

Of the Zones, Climates, and Parallels.

- 1 Of the temperate and vntemperate Zones. 204
- 2 The torrid Zone is the greatest of all: next are the two temperate: the cold Zones are the least of all. 207
- 3 The Zone wherein any place is seated, may be knowne either by the Globe, or Geographical table, or else by the tables of Latitude. 208
- 4 The Zones and Climates agree in forme, but differ in greatnesse, Number, and Office. 211
- 5 The Inuention compared one with the other, are not all of the same greatnes. 212
- 6 The inclination of the Climates. 213
- 7 The distinction of the Climates. 213
- 8 Of the diuersity betwixt the Ancient and moderne Geographers, concerning the placing and number of the Climates. 214
- 9 How to find out the Parallels for each place. 217

C H A P. X.

Of the distinction of the Inhabitants of the Terrestriall sphere.

- 1 Of the inhabitants of a right, Oblique, and Parallell sphere, with their properties and distinctions. 220
- 2 Of the Amphiceij, Heteroscij, & Periscij, with their properties. 226
- 3 Of the Periceij, Antecij, and Antipodes, with their Accidents: 228
- 4 How the Periceij, Antecij and Antipodes, are distinguished in respect of the celestiall Apparences. 231

C H A P.

C H A P. XI.

Of the Longitudes and Latitudes.

- 1 Places enjoying the same longitude, are not alwayes equally distant from the first Meridian; and contrariwise. 238
- 2 The difference of Longitudes begett; the difference of times. 238
- 3 Of the loosing or getting of a day in the whole yeere in a voyage about the earthly Globe. 238
- 4 Of the Invention of the Longitude by an Eclipse of the Moone. 240
- 5 Of the Invention of the Longitude by a Clocke, watch, or Houre-glasse. 242
- 6 By the distance betwixt the Moone and some knowne starre, to find out the Longitude. 243
- 7 By the difference of the Sunnes and Moones motion, to find out the Longitude of places. 246
- 8 The expression of the longitude by the Globe or Mappe. 247
- 9 The Invention of the Latitude. 249
- 10 By the Meridian height of the Sunne to find out the Latitude. 249
- 11 By the Meridian height of a knowne starre to know the Latitude. 250
- 12 The expression of the Latitude on the Globe or Mappe. 252
- 13 Of the Magneticall expression of the Latitude. 252

C H A P. XII.

Of distances of places compared one with the other.

- 1 Of the Invention of the distances in longitude of two places under the Equatour in the same Hemisphære. 254
- 2 Of the Invention of the distance of two places in the same Hemisphære without the Equatour. 255
- 3 Of the distance of places differing only in longitude, in diuerse Hemisphæres. 260
- 4 Of the invention of places differing onely in Latitude, either in the same or diuerse kindes of Latitude. 261
- 5 To find out the distance of places differing in Longitude and Latitude. 261

- itude by the square roote. 262
- 6 How to performe the same by the tables of Signes, Tangents, and Secants. 264
- 7 To find out the distances of places by resolution of the sphericall Triangle. 266
- 8 Of the Invention of the distance by the Semicircle. 271
- 9 Of the expression of the distance on the Globe or Mappe. 273





To my Booke.

PARUE, nec inuideo, sine me (Liber) ibis in *Aulam*,
Hei mihi quod Domino non licet ire tuo.

Goe forth thou haplesse Embrion of my Braine,
Unfashion'd as thou art; expresse the straine
And language of thy discontented Sire,
Who hardly ransom'd his poore Babe from fire,
To offer to the world and carelesse men
The timelesse fruits of his officious pen.
Thou art no lonely Darling, stamp't to please
The lookes of Greatnesse; no delight to ease
Their melancholy temper, who reiect
As idle toyes but what themselves affect.
No lucky Planet darterd forth his Rayes
To promise loue vnto thy infant-dayes:
Thou maist perhaps be marchandize for slaues.
Who sell their Authors wits and buy their graues:
Thou maist be censur'd guilty of that blame,
Which is the Midwifes fault, the Parent's shame:
Thou maist be talke for Tables, vs'd for sport
At Tauerne-meetings, pastime for the Court:
Thou maist be torne by their malicious phangs,
Who nere were taught to know a Parents pangs.

How

How easie can proud Ignorance our state
The comeliest weeds thy power can wear;
When all the Silbers on our His side
Are of fawning seruants to aspiring pride,
And our renowned Mother Athens groanes
To see her garden set with Cadmus sonnes:
Whose birth is mutual strife: whose destiny
Is only to be borne, to fight, and dy.
Prometheus is chain'd fast, and cannot mone
To steale a little fire from mighty Ioue
To people new the world; that we may see
Our Mother teeme with a new progenie;
And therefore with thy haplesse Father prone
To place thy duty where thou findest loue.
When thou arriv'st at Court thou long may'st stay
Some Friends assistance to prepare thee way;
As in a cloudy morning I haue done
When enuious Vapours shut me from the Sunne.
When all else enter, see thou humbly stand
To begge a kisse from thy Mæcenas hand;
If he vouchsafe a looke to guild thy state,
Proclayme him Noble, thy selfe fortunate.



GEOGRAPHIE: THE FIRST BOOKE.

CHAP. I.

*Of the Terrestriall Globe, the matter
and forme.*

GE O G R A P H I E is a science
which teacheth the descrip-
tion of the whole Earth.

The Nature of *Geographie* is well
expressed in the name: For *Geographie*
resolved according to the *Greeke* Ety-
mologie, signifieth as much as a de-
scription of the Earth; so that it differs frō *Cosmographie*, is a part
from the whole. Forasmuch as *Cosmographie* according to the
name, is a description of the whole world, cōprehending vnder
it as well *Geographie*, as *Astronomie*. Howbeit, I confesse, that
amongst the ancient Writers, *Cosmographie* hath been taken for
one & the selfe-same science with *Geographie*; as may appeare
by sundry treatises meereley Geographically, yet intituled by the
name of *Cosmographie*. This Science (according to our appro-
ued *Ptolomie*) is distinguished from *Chorographie* foure wayes. I.

*nt Geom
aspeio
pars catete
not*

*Ptolom. geo-
ogr. l. i. sec.*

First, because *Geographie* describeth the whole Spheare of the Earth, according to its iust *quantity, proportion, figure, and dispositions*, which the principall parts of it haue; as well in respect of one another, as of the whole Terrestrial Globe: so that it only vndertakes the chiefe and most noted parts, such as are fines, creekes, nations, cities, promontories, riuers, and famous mountaines. But the *Chorographer* separatly handleth the lesser parts, and matters of smaller moment, such as are hillocks, brooks, lakes, townes, villages, and Parishes, without any respect at all to the places adioyning, as conferring them with the *Sphericall* fabricke of the whole Earth: Which by the same Author is well illustrated by an example, drawne from the Painters Art: For wee see that a Painter, desirous to draw out and represent the head of any liuing creature, will first draw out the lineaments of the first and greatest parts; as the eyes, eares, nose, mouth, forehead, and such like; only caring that they may challenge a due and iust proportion and symmetric one with the other, not regarding the lesser particles and ornaments in each of these, wanting perhaps space competent to accomplish it. But if the same Painter would striue to expresse only an eye, or an eare, he might take space enough to designe out euery smaller lineament, colour, shadow, or marke, as if it were naturall: for in this he cares not to make it correspondent to the whole head, & other parts of the body: So happens it to the *Geographer*, who willing to delineate out any part of the Earth, (as for example, our Realme of *England*) he would describe it as an Island, encompassed round with the sea, & figured in a triangular forme, only expressing the principall and greater parts of it. But the *Chorographer* vndertaking the description of some speciall and smaller part of *England*; as for example, the City of *Oxford*, descends much more particularly to matters of small quantity and note: such as are the Churches, Colledges, Halls, Streets, Springs; giuing to each of them their due accidents, colours, lineaments, and proportion, as farre forth as Art can imitate Nature. Neither in this kind of description needs there any consideration of the places adioyning, or the generall draught of the whole Island. The second difference betweene *Geographie* and

Cho-

Chorographie assigned by *Ptolomie*, consists in this; that *Chorographie* is commonly conuersant in the accidentall qualities of each place, particularly noting vnto vs, which places are barren, fruitfull, sandy, stony, moist, dry, hot, cold, plain, or mountainous, and such like proprieties. But *Geographie* lesse regarding their qualities, inquires rather of the *Quantities, measures, distances*, which places haue aswell in regard one of the other, as of the whole Globe of the Earth: assigning to each region its true longitude, latitude, clime, parallell, and Meridian. 3^{ly}, *Geographie* and *Chorographie* are said to differ, because *Geographie* stands in little need of the Art of Painting, for as much as it is conuersant the most part about the Geometricall lineaments of the Terrestriall Globe, clayming great affinity with the Art called of the *Greekes*, *Ichonographie*; whose office is to expresse the figure and proportion of bodies, set forth in a plain superficies. But contrariwise *Chorographie* requires, as a help necessary, the Art of Painting; forasmuch as no man can fully and perfectly expresse to the eye the true portraict of cities, townes, castels, promontories, and such other things, in their true colours, liuelyhood, and proportion; except they bee skilled in the Art of Painting. So that this part is by some likened to that Art which the *Greekes* call *Sciographie* or *Seenographie*. Fourthly, and lastly, *Geographie* is distinguished from *Chorographie*, in that the former considering chiefly the quantity, measure, figure, site, & proportion of places, as well in respect one of the other, as of the *Heauens*, requires necessary helps of the Sciences Mathematicall, chiefly of *Arithmeticke*, *Geometrie*, and *Astronomie*, without which a *Geographer* would shew himselfe euery-where lame & impotent, being not able to wade thorough the least part of his profession: whereas a man altogether vnpractised in those faculties, might obtaine a competent knowledge in *Chorography*. As we find by experience, some altogether ignorant in the Mathematicks; who can, to some content of their hearers, *Topographically*, and *Historically* discourse of Countries, as they haue read of in books, or obserued in their trauaile. Notwithstanding all these differences assigned by *Ptolomie*, I see no great reason why *Chorography* should not bee referred to *Geography*; as a

part to the whole; forasmuch as the objects on which hee hath grounded his distinction, differ only as a generall and a speciall; which being not opposite, but subordinate (as the *Logicians* vse to speake) cannot make two distinct Sciences, but are reduced to one and the selfe-same: at least the differences thus assigned, will not be *Essentiall* but *Accidentall*. Wherefore my scope in this Treatise shall bee to ioine them both together in the same, so far forth as my Art and leisure shall be able, to descend to particulars; which being in *Chorographie* almost infinite, will not all seeme alike necessary in the description of the vniuersall Globe of the Earth. The name of *Geographie* thus distinguished, wee define it to be a *Science* which teacheth the *Measure* and *Description* of the whole *Earth*. It is properly tearmed a *Science*, because it proposeth to it selfe no other end but knowledge; whereas those faculties are commonly tearmed *Arts*, which are not contented with a bare knowledge or speculation, but are directed to some farther worke or action. But here a doubt seemes to arise, whether this *Science* be to be esteemed *Physicall*, or *Mathematicall*? Wee answer, that in a *Science* two things are to bee considered: first, the *matter* or object whereabout it is conuerfant; secondly, the *manner* of handling and explication: For the former, no doubt can bee made, but that the object in *Geographie* is for the most part *Physicall*, consisting of the parts whereof the Spheare is composed: but for the manner of Explication, it is not *pure*, but *mixt*; as in the former part *Mathematicall*, in the second rather *Historicall*; whence the whole *Science* may be alike tearmed *Mathematicall* & *Historicall*; not in respect of the *Subiect* which we haue said to be *Physicall*, but in the manner of *Explication*. For the object of *Geographie* (as we haue intimated) is the whole Globe of the Earth: where we are to obserue, that the Earth may bee considered 3 manner of wayes: First, as it is an *Element*, out of which *mixt* Bodies are in part compounded: In which sense it appertaines to *Naturall Philosophie*, whose office is to treat of all naturall bodies, their principles and proprieties. Secondly, as it is supposed to be the center of heauenly motions, and so it is vnderaken by *Astronomers*. Thirdly according to its *Sphericall*

Super-

Superficies, as it is proposed to bee measured or described, in which manner it is the subject of *Geographie*, so far forth as the parts of it haue a diuerse situation, as well in regard one of another, as in respect of the Heauens. Which restriction, although agreeing well to some part of it, will hardly square with all the rest: because many things herein are handled besides the Earths naturall site or position, as hereafter shall be taught. For which cause wee haue rather defined the subject of *Geographie* to bee the *Earth*, so far as it is to bee measured and described, as wanting one word to expresse the whole manner of consideration.

2. *Geographie* consists of 2 parts, the Sphericall, and Topicall: The Sphericall part is that which teacheth the naturall constitution of the Terrestriall Spheare.

The common and receiued diuision of this *Science* amongst *Geographers*, is into the *Generall* or vniuersall part; and the *speciall*. Which diuision, I dare not vtterly reiect; being strengthened with the authority of ancient and approued Authors. Yet seems it more aptly to be applyed to the *Historicall* part, then to the whole *Science*, as we shall after make apparant. In the meantime the diuision of it into Sphericall & Topicall parts, seemes to be preferred in reason: Forasmuch as the *Terrestriall Globe*, which we suppose to be the subject of the *Science*, is proposed to vs vnder a twofold consideration; first in regard of the *Mathematicall* lineaments and circles, whereof the Spheare is imagined to consist; out of which wee collect the figure, quantity, site, and due proportion of the Earth, and its parts: Secondly, of the places *Historically* noted and designed out vnto vs, by certaine names, markes, and characters. The former receiueeth greatest light from *Astronomie*, whence some haue called it the *Astronomicall* part: The later from *Philosophie* and *Historicall* obseruation, being (as we haue said) a mixt *Science*, taking part of diuers faculties.

- 3 The Terrestriall Spheare is a globous or round Body, comprehended within the *superficies* of the Earth and Water.

Some haue nicely distinguished betwixt a *Spheare* & an *Orbe*, that a *Spheare* is a round massie body, contained in one surface, which is conuexe or outward as a Bowle. The other concaue, or hollow, in manner of an Egge-shell emptied. But this distinction seemes too curious, as fauouring too much of Scholasticall subtilty, because the name of *Orbe* and *Spheare* are many times promiscuously vsed, without difference, amongst good Writers. This *Spheare* which wee make the subject of our Science, wee call *Terrestriall*, not because it consists meereley of Earth; (the contrary of which wee shall hereafter shew:) but because the Earth is the chiefeft in the composition; whence by a tropicall kind of speech, the whole *Globe* may bee called *Terrestriall*.

- 4 The handling of the Terrestriall Spheare is is either *Primary*, or *Secondary*. The *Primary* consists in such affections as primarily agree to the Earth.

The *Geographicall Affection* may be considered two wayes; either *simply* and absolutely in themselves; or *comparatiuely* as they are conferred and compared the one with the other. As for example, the circles of the *Spheare*, such as are the *Parallels* and *Meridians*, may be considered either absolutely in themselves; or comparatiuely as they concur to the *longitude*, *latitude*, *distance*, or such like accidents, which arise out of the comparison of one Circle with another.

- 5 The Terrestriall Spheare primarily considered, is either *Naturall*, or *Artificiall*. The *Naturall* is the true Globe in it selfe, without image or representation.

6 Herein againe are to be considered two things; First, the *Principles* and constitution of the Spheare; Secondly, the *Accidents* and proprieties: The principles whereof the Spheare is composed are two; viz: *Matter* and *Forme*.

7 The Matter is the substance whereof the Spheare is made, viz: Earth, and Water.

My meaning is not in this Treatise to handle the nature and proprieties of these two Elements, *Water*, & *Earth*, farther then may seeme necessary for the Geographicall constitution of the *Terrestriall Spheare*, leauing the rest to the Naturall Philosopher; because it is supposed that few men vndertake the study of this Science, without some insight in the other. And to speake truth, this begins where the Naturall Philosopher ends. Yet because some light in each learning is necessarily required and all men are not willing to seeke farther into the grounds of *Naturall Philosophie*; it will not seeme altogether impertinent, to lay the foundation farther off, that the building thereon erected may stand surer and stronger. Wherefore taking some beginning from the matter of the Earthly Globe, wee haue distinguished it into *Earth*, and *Water*, as those parts whereof the whole Globe is not essentially compounded, as one intire body in it selfe; but rather coaceruated and compacted together, each part retaining its owne nature and proprieties, without any proper mixture. To expresse more fully the constitution of this Spheare, we are here to distinguish betwixt the *first* and *second matter*. The first matter was that vniuersall *chaos*, or masse, out of which, all bodies both Celestiall and Elementary were made and formed, as wee read in the first of *Genesis*. Which whether it be the same with *Aristotle's Materia prima*, as some haue imagined, I leaue to others to dispute. The second matter of the Globe is either *Proper* or *Accidentall*. The proper we call that

whereof

whereof the Globe of the Earth most properly consists, such as are the two Elements of *Earth* and *Water*. The Accidentall matter is vnderstood of all other bodies, contained in the *superficies* of the said Spheare, as *Stones*, *Metalls*, *Minerals*, and such like materials, made of a Terrestriall substance, and engendred in the wombe of the Earth. Concerning the *Earth* and *Water*, which we make the most proper and essentiall parts of the Spheare, we will set downe these two Theoremes.

1 In the Terrestriall Spheare is more Earth then Water.

The Theoreme may bee proued by sundry reasons drawne from *Nature* and *Experience*. Whereof the first may bee taken from the depth of the waters, compared with the whole thickness of the Earth. For the ordinary depth of the Sea is seldome found to be about 2 or 3 miles, and in few places 10 furlongs, which make a mile and a quarter. And albeit some late Writers haue imagined the obseruation to be vnderstood only of *straight* and *narrow Seas*, and not of the maine Ocean: yet granting it to amount to 10, 20, or 30 miles, it cannot reach to so great a quantity, as to come neere the greatnes of the Earth. For the whole circle of the Terrestriall Spheare being 21600 English miles, (allowing 60 English miles to a degree of a greater circle) wee shall find the Diameter to bee about 7200 miles: Whose semi-diameter, measuring the distance betweene the center and the *superficies* of the Earth, will be 3600 miles. And if any man suppose some of the quantity to be abated, because of the Spheticall swelling of the *Water* about the *Earth*, whose Circle must be greater than that of the Earth: We answer; first that this may challenge some abatement, but not come neere any equality of the *Water* with the *Earth*. Secondly it is to bee imagined that the surface of the Sea, howsoeuer as it is painted in Globes and Charts, it seeme for a great part empty and vninhabited of Islands; yet this for the greatest part, seeme rather to bee ascribed to mans ignorance, and want of true discovery, because many quilletts and parcels of land lye yet vnknowne to our Christian World, and therefore omitted, and not figured in

our ordinary Mappes. So wee find a great quantity of Earth which lay hid and vnknowne without discouery, in the dayes of *Pytolomy*, which caused him to contract & curtaile the Earth in his *Geographicall* descriptions. Which defect hath been since that time supplied by the industrious trauailes and Navigations of later time: such as were of *Portugals*, *English*, and *Hollanders*, especially of *Columbus* the *Italian*, who (as one wittily alluding to his name) like *Noah's* Doue plucking an oliue branch from this Land, gaue testimony of a portion of Land as yet vnknowne, and left naked vnto discouery. And no question can be made, but a great quantity of land, not yet detected by our *European* Navigators, awaites the industry of this age. To which alludes the Poët in these Verses:

*Venient annis secula seris,
Quibus Oceanus vincula rerum
Laxet, & ingens pateat tellus,
Typhisq; novos detegat orbes,
Nec sit terris vltima Thule.*

*Seneca in
Medea.
Act. 2.*

In after-yeeres shall Ages come,
When th' Ocean shall vnloose the bands
Of things; and shew vast ample lands;
New Worlds by Sea-men shall be found,
Nor *Thule* be the vtmost bound.

Another reason to proue the Earth to be greater in quantity, may bee drawne from the mixture of *Earth* and *Water*: for if these two Elements should meet in the same quantity, & challenge an equality; questionlesse the whole Earth would proue ouer-moist, stymie, and vnapt for habitation. Which any man may easily obserue by his owne experience. For let a portion of Earth, & another of Water be mixt together in the same quantity, the whole masse will seeme no other than a heap of mire or slime; without any solid or consoling substance. Moreouer the *Water* being no other than a thin and fluid body, hardly containing it selfe within its own bounds or limits (as *Aristotle* tea-

*De gen. &
cor.
cheth*

cheth vs) must needs require a hard and solid body, whereon to support it selfe, which body must of necessity bee greater in quantity.

2 *The Earth and Water together make one Spheare.*

It may bee probably collected from sundry places of holy *Scripture*, that in the first Creation, the surface of the Earth; being round and vniforme, was ouerwhelmed and compassed round with Waters, as yet vnfurnished of liuing Creatures. Secondly, it appeares that *Almighty GOD* afterwards made a separation betwixt the *Waters* and *Dry-Land*. This separation (as farre as reason may bee admitted as Iudge) seemes to bee effected one of these two wayes: Either by giuing super-naturall bounds and limits vnto the Waters, not suffering them to inuade the *Dry-land*: or els by altering the *superficies* of the Earth, casting it into inequall parts, so that some-where, some parts of it being taken away, empty channels or concavities might be left to receive the Waters; other-where by heaping vp the parts so taken away, whence were caused *Mountaines* and eminent places on the earth. The former of these wayes seemes altogether improbable; forasmuch as it is very unlikely to imagine, that God in the first institution of Nature, should impose a perpetuall violence vpon Nature, as hereafter in place more conuenient shall bee demonstrated. Wherefore taking the later as more consonant to reason; we shall find that the Water & the Earth separated and diuided, make not two separate and distinct Globes, but one and the same Spheare; forasmuch as the concavities and hollow gapings of the Earth, are euery-where choaked and filled vp with Water, whose *superficies* is Spharicall; and therefore helpes, together with the Earth, to accomplish & perfect this *Terrestriall Spheare*. To confirme which opinion, these reasons out of common experience may be alleadged: The first is drawn from the parts of Earth and Water; For we may euery-where obserue, that a portion of Earth, and another of Water being let fall, will descend in the same right line toward the same center: whence we may euidently conclude, that the
Earth

Earth & Water haue one and the selfe-same center of their motion, and by a consequence conspire to the composition of one and the selfe-same *Spheare*. Secondly, to a like Arch or space in the Heauens, is found answerable alike Arch in the *Terrestriall Globe*, whether it bee measured by the Earth or Water: which could not happen, were they not accounted parts of the same *Spheare*. The third reason may bee drawne from the *Eclipse* of the Moone, wherein the part of the Moone shadowed & obscured, is obserued to be one Spharicall or round-figure. This shadow, by the consent of all *Astronomer's* is caused by the *Terrestriall Spheare*, interposed betwixt the Sun and the Moone, intercepting the Sun-beames, which should illuminate the Moone; and the shadowes imitate the opacous bodies, whence they arise: But in the *Eclipse* we find only the shadow of one body or *Spheare*, and therefore according to the ground of the *Opticks*, we may conclude the body whereof such a shadow proceedeth, to be but one and the selfe-same *Spheare*.

8 The *Forme* of the *Terrestriall Spheare*, is the naturall Harmony or order, arising from the parts working together.

We ought here to remember what we said before; that the Earth and the Water concurre together to make one *Terrestriall Spheare*: wherefore the whole being accounted one coacernated and collected *Body*, made of two other; we are not to expect an *Internall*, *Essentiall*, and *Specificall* *Forme*, such as *Aristotle* recounts amongst the principles of a *Naturall Body*: but only such a one as in it selfe is *Externall* and *Accidental*; yet concurring (as it were) *Essentially* to the constitution of the *Terrestriall Spheare*, whose *Fabricke* and first composition, cannot well be vnderstood without it. Some haue imagined the whole *Globe* of the Earth to bee informed with one *Internall* and *Essentiall* *Forme*; which opinion seemes to haue much affinity with that of *Plato's*, concerning the *Soule* of the *World*: Not that *Plato* and his followers were so absurd to defend, that the *World* with all his parts was animated with a true vitall *Soule*, in the nature of a liuing Creature: but that all the members of
it

it were vnited together, quickned, and disposed by a certaine *Energeticall* power or vertue, which had great resemblance and representation of the Soule of man. Which assertion seemes, to be restored and embraced by our late *Magneticall Philosophers*, whose opinion we shall discusse and examine hereafter in place conuenient. In the meane time, grounding our discourse on knowne principles; we can admit no other *Forme* in the *Spheare* of the Earth, then the mutuall *Harmony*, order and concent of the parts, concurring together, and working the perfection & perpetuation of the whole. A fit resemblance whereof we may obserue in an artificiall Clock, Mill, or such like great Engine, wherein euery part duly performing its owne office, there will arise and result a naturall Harmony, which not vnaptly may be termed the *Forme* of the whole Engine. Why the World should not consist of an Internall and Essentiall *Forme*, sundry reasons haue been allcaded by our common *Philosophers*: First, because Nature neuer attempteth any thing in vaine; or without a determinate end; But the particular *Formes* of speciall Bodies (say these *Philosophers*) are sufficient for the vnity and conformation of this *Terrestriall Globe*: so that to grant an vniuersall *Forme* of the whole, were to multiply causes without any necessity, & make Nature the Mother of superfluity, which to all *Philosophers* seemes most absurd. Secondly, if this were admitted; the whole *Spheare* of the Earth would bee as one continueate Body, whose parts should (as it were) suffer a fellow-feeling one of the other. Thirdly, it were a difficult matter to assigne, to what kind such a *Forme* might be reduced, whether *Animate*, or *Inanimate*. If *Inanimate*, whether it were *simple*, or *compound*. If *Animate*, whether *Vegetatiue*, *Sensitiue*, or *Rationall*; vnder the which are couched many great difficulties, as yet vndisclosed. Whether these reasons bee of any great force to ouerthrow the aduerse opinion, I leaue it to further inquiry: intending here a *Geographicall*, not a *Physicall* Discourse.

CHAP. II.

*Of the conformity of parts in the constitution
of the Terrestriall Spheare.*

- 1 IN the former we haue treated of the *Natural* constitution of the Terrestriall Spheare, aswell in *Matter* as *Forme*: It is needfull in the next place to treat of such *Affections* and proprieties as necessarily arise out of such a Constitution.
- 2 Those *Affections* or Proprieties are of two sorts, *Reall* or *Imaginarie*; *Reall* I call such as agree to the Terrestriall Globe by Nature: *Imaginary*, such as agree to it by vertue of our vnderstanding.
- 3 Again the *Affections* *Really* or *Naturally* agreeing to the Terrene Spheare, are assigned either in respect of the *Earth* it selfe, or in respect of the *Heauens*.
- 4 These *Affections* are said to agree to the *Earth* in respect of it selfe, which may be expressed and vnderstood without any comparing of it with the celestiall Bodies.
- 5 These againe are twofold; either *Elementarie*, or *Magneticall*. *Elementary* I terme
B 3 such

such as haue commonly been knowne or obserued by ordinary Philosophers. Here is chiefly to bee considered the conformity of the Terrestriall parts, in the making and constitution of the whole Spheare.

In the former Chapter we haue shewed, that the Forme of the *Terrestriall Spheare*, is nothing els but the concinnity and apt conspiration of the parts whereof the whole is compounded. This conformity being diuers and manifold, as well in regard of the parts conforming themselves, as the manner; of the conformity, we shall particularly and distinctly treat of, so far as appertaines to a *Cosmographer*. Here by the way I cannot but taxe some defect in most of our common *Cosmographers*, who taking the *Sphericall* roundnes of the Earth for a granted supposition, are nothing curious to search into the first grounds and causes of this roundity, whereby it first became a globous Body; and afterwards retaines in it selfe a Naturall vigour or power (if any violence should be offered) to restore her selfe to her former right and perfection. All which are very pleasant & profitable, to giue an industrious Learner some satisfaction. To explaine this before we descend to particulars, we will lay this ground and Theoreme;

I *The parts of the Terrestriall Spheare, doe naturally conforme and dispose themselves, as well to the production and generation, as to the continuance and preservation of it.*

The forme of the *Terrestriall Spheare*, albeit (as wee haue shewed) it be *Externall* in respect of the whole Globe; yet may we call it *naturall*; forasmuch as it issueth and ariseth from the naturall disposition and inclination of all the parts. To vnderstand which clause the better, wee are to consider that a thing may bee called *Naturall* two manner of wayes: first in regard of the *primary* intent of Nature; as the neerest and immediate
end

end or scope to which shee is directed. Secondly, in respect of her *secondary* intent or purpose, as that which must of necessity follow the former. True it is that every Terrene Body, according to Natures *first* intention, seeks and works it's owne perfection and conseruation. Neuertheless according to her *secondary* Intent, it concures to the perfection and good of the whole vniuerse; which we shall plainly see in a stone or clodd of earth; which separated and remoued from it's mother, the Spheare of the Earth, by his descent and falling downewards, seeks first his owne conseruation, by reuniting it selfe to the Earth whence it was taken: Secondly, of the whole Globe of the Earth, which by this vnion and addition, no doubt, is made more compleat and perfect: This conformity of the Terrestrial parts, out of which ariseth the Earths *Sphericity*; I call the natural inclination they haue to moue and settle themselves in such a site or position, as may bring forth a *Sphericall* consistency: so that if it were possible (as what cannot be to Gods Almighty power?) that the whole Globe of the earth were dissolued and rent into little peeces; yet were that vigor and motiue inclination remaining in the parts, whereby they might settle and conforme themselves to the same *Sphericall* nature, and composition which it formerly enjoyed. For all the parts thus supposed to be distracted, would (no question) meet together & conforme themselves to the same point or Center; and so equally poising themselves, would restore the same Spheare so dissolued. So that wee here note a double inclination and motion of earthly bodies; first by a *Right line*, of the parts tending towards the Center; the other *Sphericall* of the whole Spheare, whereof the first in nature preceedes the composition of the Spheare, the other follows. But this latter motion I leaue doubtfull, till place conuenient.

- 6 The conformity of the Terrene parts is twofold; *Primarie*, or *Secondary*. The former is that whereby all earthly bodies are by a right line carried and directed to the Center
of

of the Terrestrial Globe.

As in an *Artificiall* Spheare or circle, drawne by a Geometrician, their principall parts are expressed, to wit, the Center, Ray, and circumference: so in the *Naturall* Globe of the Earth, these three, as it were Naturally & Really discover themselves vnto vs. For first there is set a fixt point, to which all heavy bodies moue and conforme themselves. Secondly, there is set the line, or *Radius*, in which such bodies are carryed and conueyed. Thirdly, the confluence of all these parts, begets the roundnesse and Sphericall forme. To begin first with that which is first in nature, we will take these grounds.

I *All Earthly Bodies incline and approach to the Center as neere as they can.*

This proposition so farre forth as it concerns the two Elements of *Earth* and *Water*, is confirmed by common experience, and therefore needs no long demonstration. For we see plainly, that not only these two doe incline (as much as may be; all obstacles being remoued) to the Center of the Earth; but also all mixt bodies compounded of them, being ouerswayed with the most predominant element, doe challenge to themselves the same motion. I say not that all these Terrestriall bodies drine & meet in the Center (for that were impossible, that all this massy Spheare should bee contracted to one point) but that all the parts haue a mutuall inclination to approach as neere the Center, as the necessity of the place, and the concurrence of them amongst themselves will suffer. By these Terrestriall Bodies which inioye this motion and inclination; wee vnderstand first the two Elements of *Earth* and *Water*, with all other bodies arising out of their mixture. To these I may adde the *Ayre*, which by reason of his affinity with the Earth and Water, and naturall cōformity to the same Center, we may well tearme an earthly body. It is commonly reported that the *Ayre* is *light*, and therefore carried vpwards, not inclining at all to the Center of the Terrestriall Globe; as the parts of these two Elements are. But this assertion, although bolstered vp, both with antiquity and authority; I take either to bee false, or misunderstood, and

and that I speake no more herein than I can prone; I will produce some reasons (strong enough, as I thinke) to perswade that the Ayre is a heauy body, hauing a due inclination and conformity to the Center of the Earth: First therefore will I produce this experiment. When a Well or deepe Trench is digged vp in the earth, I would willingly demand whether the Aire descends to fill up this Trench or concauity; or else a void space is left vnturnished of any naturall body to fill it? If they admit the latter, they will consequently bring in againe that *VACUUM*, or void space which *Arist.* and all sound Philosophers haue long since proscribed the confines of nature. If they affirme the former, that the Ayre descends to fill vp this empty space, I wil aske againe, whether this descent of the Ayre be violent or naturall. If they say Naturall, they admit our assercion, that the Ayre naturally descends towards the Center, and so by consequence that it is heauy and not light by nature. Neither according to our *Peripateticall* Philosophy can wee ascribe more than one motion to the Aire, because it is a ground generally receaued among *Aristoteleans*: that One simple body can claime but one simple motion: much lesse one simple forme, as that of the Aire, can produce two opposite and contrary motions, such as are Ascent and Descent of the same body. If they chance to light on the other member of our distinction, and say that the motion of the Aire in this sort is violent, it must needs follow, that it must haue some externall cause or principle whence it should proceed; because all such motions proceed from externall causes. But here no such cause can be assigned: For the cause would bee either the Earth which is so made hollow, or the emptinessse, or *VACUUM*, or at least the other parts of the Aire. That it is not the Earth, may be proued; first because no Philosopher hath euer shewed any such Attractive power to reside in the Earth, but rather the contrary; because the Earth and Ayre by most haue beene thought opposite in nature, and repugnant one to the other. Secondly, because Philosophy teacheth, that no agent can worke vpon a separate and distinct patient, except there be a meeting of the Agent and Patient in some meane, But here in this supposition, the Earth is imagined to drawe and attract

the Aire, which as yet it toucheth not. That this externall cause is not the *Vacuum* or Emptinesse, is plaine; because it was neuer granted to haue any being or exsistence, much lesse any causality in nature. Some perhaps will say, that not the *Vacuum* it selfe, but the euitation and auoiding it, is the cause of the motion. I deny not but this may in some sort be interpreted a cause, but the doubt is not answered: For wee seeke not a *Finall* but an *Efficient* cause; and a curious searcher into Nature, will hardly rest in a meere finall cause. For the finall cause, so farre forth as it is a cause preceeding the effect, can no otherwise bee conceiued than in the intention of the Agent: then must enquiry bee made againe what the Agent should bee, and so will the probleme rest vncleered. 1. Because one parcell of the Aire could not moue another, except the same were first moued it selfe, and so a new Agent must of necessity bee found out. 2 The Agent and the thing moued or Patient, ought to bee two separate and distinct bodies: But the parts of the ayre meeting together, become one continue body. No shift is there left for these Philosophers but one distinction, wherein they distinguish betwixt the *Vniuersall* and *Speciall* forme, The Aire, as they affirme, according to his *Speciall* forme, ascends vpward from the Center of the *Earth*: yet by the *Vniuersall*, for the conseruation of the whole vniuerse, it may sometimes suffer a contrary motion, as to moue downward toward the Center. In which distinction they suppose they haue cut the throat of all contrary reasons. But who so vnderstands himselfe, shall finde it but as a weake reed, to hurt his hand which rests on it: for a second enquiry will bee made, what this vniuersall forme should bee. For by it they vnderstand of necessity either an *Internall forme* or Nature; or an *Externall* *resiliencie* and harmony of the parts, such as wee haue described in the first Chapter of this booke. If they vnderstand this latter, it cannot any way bee a cause of this motion; because it followes and ariseth out of this motion concurring with the rest, and no way preceeds it: whereas on the contrary, part enery cause is to goe before his effect: Secondly, this vniuersall forme or nature compared with the speciall, there would arise a *Subordination*, and not a *Coordination*,

tion, or opposition; forasmuch as the speciall is subordinate to the generall or vniuersall. But subordinate causes can produce no other than subordinate effects. But here we see the effects or motions to bee quite opposite the one to the other; in asmuch as the motion of Descent in the Aire (which they ascribe to the vniuersall forme) is cleane opposite to the motion of Ascent, ascribed to the speciall nature. Thirdly, these *Philosophers* vrging the necessity of Nature to preserve the Vniuerse, are much decaued in the manner and meanes thereof. True it is that all Earthly and heavy bodies are directed and disposed to the conseruation of the earthly Globe. But euery such body (as wee haue shewed before) seekes first the safeguard and preservation of it selfe, and secondarily by the safeguard of it selfe the preservation of the whole. For how can any part, when it neglects its owne safety, endeaour the preservation of the whole: sith the whole is but one compounded of many parts. And therefore can it not bee auoided, but that the disorders and disharmony of one part, should preiudice and destroy the whole frame. If they turne to the other part, and grant this vniuersall forme to bee *Internall*, many reasons stand opposite. For first I would demand, whether this vniuersall forme bee *simple* or *compounded*. It cannot bee *simple*, because it would alwayes produce one simple and vniforme effect: but experience hath taught the contrary; because wee shall not alwayes find the aire to descend, but sometimes to moue obliquely to the left or right hand, backward and forward; as when it enters into the house by a doore or windowe. On the other side, it cannot well be called a compound forme; because all formes the more vniuersall they are, the more simple they are to be accounted: because the speciall includes more composition than the generall. Moreouer, all compounded substance arise out of simples, which are to bee esteemed first in nature. Secondly, I would aske whether this vniuersall forme bee *una numero*, the selfe same indiuiduall in all the parts and bodies; or diuerse, according to the diuersity of the said Bodies. It cannot bee one and the selfe same in all bodies, because, according to the opinion of *Aristotle*, the whole vniuerse is not one continue body composed of essentiall parts;

but rather a heape or masse collected and digested out of many bodies. Secondly, the forme being thus one individuall, would bee singular or speciall, not vniuersall. If they affirme that this forme is diuerse according to the diuersity of the bodies, it cannot bee the cause of this motion or descent in the Aire. For this motion (as they suppose) is destined and appointed to no other end, than to comfort Nature in her distresse, when shee stands in feare of rupture or dissolution. But how can this forme being bounded within the limits of the Aeriall *superficies* perceauce or feele this exigence of Nature in other Bodies? Whatsoever they can say in this, is altogether vncertaine, and not warranted by any sound demonstration. A second reason for the naturall descent of the Aire, may bee drawne from a possible supposition; from which wee may enforce a true conclusion. Let vs suppose a portion of Aire by some violence to bee carried aboue his proper orbe; as for example, to the space which by our common Philosophers is ascribed to the Element of Fire, neere the concave *superficies* of the Moone, I would here demand whether this portion of Aire thus transposed would ascend higher, or descend lower, or rest still in the same place? It could not ascend higher; first because in this wise it should be moued farther out of his owne place, whereas according to the principles of Philosophie, all bodies transposed from their proper places, haue an aptnesse or inclination to returne againe to their proper seats, and not to roue farther off. Secondly, this granted, the Aire should inuade the place of the fire and so the Elements should suffer a confusion; which *Aristotle* holds absurd. Thirdly, there cannot be imagined in that higher orbe any point or center, to which it should direct his motion; and therefore there is no such motion found; or it must bee very irregular. If on the other side it were granted, that such a portion of Aire so separated, should descend; I aske againe, whether they hold this motion *naturall* or *violent*: It cannot bee a violent motion; because it is directed to his owne naturall and proper place; and this motion in the Elements, is alwayes accounted naturall. Last of all, it cannot rest still in the same place, because all bodies forced out of their places (all obstacles being remoued) must
needs

needs returne vnto their proper place. Wherefore no other starting hole is here left to our opposites, but that they grant a naturall motion, and so consequently yeeld to our assertion. A third reason may here bee drawne from the condensation of the Aire. It is a receiued opinion amongst most Philosophers, that the thinne and subtile parts of the Aire will naturally mount vpward; but the thicker and condensed parts, pitch and settle themselues downeward: Which obseruation, if it bee true, will yeeld vs this conclusion. That the Aire is by nature heauy, and therefore moueth downeward, toward the center of the Sphericall Globe of the Earth. Which I will demonstrate out of these Principles, 1 That that body, which by addition of parts or condensation, is made more heauy or ponderous, must needs haue some weight in it selfe. This may easily appeare, because the mixture of lightnesse with heauinesse will not intend and encrease the ponderosity, but slacke and diminish it. For the chiefeft thing which remits or diminisheth any quality, is the mixture of his contrary, as wee see the quality of cold to be abated and weakened if it entertaine any mixture of heat: 2 The thickning or condensation of any body is made by addition and coaction of more parts into the same space or compasse. As if the Aire or any such like body were thickned, it would confine it selfe to a more narrow roome then before, and so consequently the narrow roome would containe more parts then before. Out of which wee conclude, that forasmuch as many parts pressed together in the same space, make the whole masse more ponderous; these parts so pressed together, must needes haue some waight in themselues. Which may further be illustrated; because the intention of the quality commonly folowes the condensation of the subiect: Which may easily appeare in red-hot-iron, which burnes and scorseth more than flame or coales; because euery part hath more degrees of heat. Now where more parts are closely pressed together, the heat must needs bee more feruent. I haue dwelt longer on this subiect, because I would not seeme to broach a new opinion without sufficient reason. To conclude all, and come as neere the receiued opinion as I can; I will say, that the Aire may bee consid-

dered two wayes; first *absolutely* in it selfe; secondly in *comparison* of heavier bodies, to wit, the *Earth* and *Water*. In the first sense I grant no absolute lightnesse in the *Aire*; because out of his naturall inclination, it tends as neere as it can to the center, as all other lower bodies. But if we consider it comparatively in respect of other heavier bodies, we may call it light, that is, lesse heavy or ponderous. So that by *lightnesse* we vnderstand no *absolute* lightnesse, but a *privation*. The summe of all wee haue hitherto proued, is this; That all terrene bodies, as *Earth*, *Water*, *Aire*, and other mixt bodies which concur to the composition of the Earthly Spheare, as neere as they can, settle and conforme themselves to the center of the *Earth*; which site or position of them to the center, is their true and naturall place, wherein they seeke their preservation.

2 Of two heavy Bodies striving for the same place, that alwaies preuaileth which is heaviest.

3 Hence it comes to passe that the *Earth* enjoyes the lowest place, the next the *Water*, and the last the *Aire*.

The increment or increase of any effect, must necessarily arise from the greater vigour or efficacy of the efficient cause, as both Reason and Philosophie well teach. Now (as wee haue shewed) all heavy bodies naturally do descend downward, out of a naturall inclination they haue to attaine the center: but where there is a greater weight, or consipation of ponderous parts in the same masse, there must needs proceede a greater inclination: Supposing then the *Earth*, *Water*, and *Aire*, being three weighty bodies to incline and dispose themselves to their vttermost force to inclose and engirt the center of the Terrestriall Spheare; it must needes bee that the *Earth* being the most compact and ponderous, must obtaine the preheminence; next to which succeedes the *Water*, then the *Aire*, being of all other the

the least ponderous. Yet wee deny not but the Water and Aire being settled in this wise, are in their naturall places; which to vnderstand, wee must repeat what we said before, that Nature hath a twofold *intention*; the one *primary*, the other *secondary*. Indeed if we consider Natures primary or speciall inclination in the bodies themselves, we shall finde them (as wee said) immediately directed to the center as neere as might bee: but the secondary intent of Nature was, that the bodies should so settle and conforme themselves, as that each of them should obtaine a place according to his degree of massinesse and waight. Out of this may bee answered a certame obiection which some haue produced, to prone the Aire to bee absolutely light in his owne nature. Experience teacheth vs (say these men) that a bladder blowne vp with winde, or an empty barrell being by force kept vnder water, the force and obstacle omitted, will suddenly ascend to the top; and that a man ready to sinke in the Water, will not so easily sinke downe while hee can hold his breath: all which effects they ascribe to no other cause, than to inclination of the Aire to moue vpwards from the center. But indeed this motion, howbeit agreeable to the vniuersall nature and consistency of the Spheare, is notwithstanding in respect of the Aire it selfe, vnnaturall and violent; because this ascent of it is not caused by the forme of the Aire, but the interposition of a heauier body struiuing for the same place, and so reuerberating it backe from the place, wherunto it tended. For here is to bee imagined, that the bladder or empty barrell drowned in the water, claimes and inioyes for the time that place or distance, which otherwise so much water should occupie; to wit, so many inches of feete from one side to the other. No maruell then that obstacles remoued, the Water being most ponderous and waighty, receiues his owne right, and (as it were) shoulders out the Aire, and violently driues it off to his owne habitation. Whence many haue imagined that this motion is proper and naturall to the Aire, when of it selfe it is meereely violent, and enforced by the interiection of another body more waighty and ponderous than it selfe.

the Aire proceeds
right

the obstacle

- 7 this conformity of the Terrestriall parts, two things are to bee obserued: 1 The center it selfe: 2 The parts which conforme themselves vnto it. The Center is an imaginary point in the midst of the Terrestriall Globe, to which all the parts are conformed.

The Fathers of the *Mathematicall* Sciences, haue laboured to deriue all their doctrine from a point, as the first and most simple principle whereon all the rest depend. Not that they imagine a point to bee any positive *entity* in it selfe; but because it is the first bound of magnitude, whence all terminated quantities take their originall. The first principle wee may call it, not of naturall constitution, because a thousand points collected, could not be so compounded, as out of it should arise the least magnitude; for (as the Philosopher hath taught vs) con-
 tinue and diuisible things cannot bee made out of such things as are merely discontinuate and indiuisible, but because it is the first Mathematicall principle or beginning of termination and figuration. This point, although it haue euery-where an vse in *Geometrie*, yet no-where more remarkable then when it becomes the center of a circle: which center wee ought not to imagine a meere *Geometrical* conceit, but such as findes ground in the *Naturall* constitution of the *Terrestriall Sphere*. For seeing all terrene bodies are carried in a right line as by a *Radius* to one point, from euery part of the circumference; we may obserue a center as it were designed and pointed out by Nature it selfe in the Globe. Some haue here distinguished betwix a point *Physicall*, and a point *Mathematicall*, as allotting the former *Latitude*, and sensible existence; but making the other merely *Indiuisible*. But if the matter bee rightly vnderstood, they are not two points, but all one, distinguished only by a diuers name of conceit or consideration. For wee consider first a point as it is existent in a sensible particular body, and so we call it

it *Physicall*. Secondly wee abstrackt it from this or that body sensible; but alwayes conceit it withall to bee in some body, and in this sort wee terme it *Mathematicall*: for the Mathematician abstracts not a *Quantity* or *Quantitative* signe from all subiects; for so being an accident, hee should conceiue it abstracted from its owne nature; but from this or that sensible body, as wood or stone. Such a point ought we to imagine the center of the Earth to be, not participating of any latitude or magnitude, albeit existent in some magnitude. I am not ignorant that some Writers haue taken a *Physicall* point for a sinall and insensible magnitude, in which sense the Globe of the Earth is called the center of all heavenly motions. But this sense is very improper; and besides in this example is to bee vnderstood a point *Opticall*, as such as carries no sensible or proportionable quantity in regard of the sight. Taking then the center of the Earth to bee a point fixt in the middest of the Earthly Spheare, as we haue described, wee will further describe the nature of it in two Theoremes.

The center of the Earth is not an Attractive,
but a meere Respectiue point.

An *Attractive* point I terme that, which hath in it a vertue or power to draw and attract the Terrestriall parts or bodies, in such sort as the Loadstone hath a power to draw iron or Steele. But a *Respectiue* point is that, which the Bodies in their motions doe respect and conformance themselves vnto, as the bound or center to which their course is directed. Which may bee illustrated by the *directiue* operations of the Loadstone (which wee shall hereafter handle) by which the *Magneticall* Indix or needle pointeth directly Northward: not that in the North is fixed any Attractive vertue or operation, which might cause that effect; but because the Magneticall Instrument is directed towards such a point or center. That the Center of the earth hath no Attractive force, may bee proued, 1 Because it cannot in any probability bee thought that an Imaginary point hauing only a *primatiue* Being and subsistence, should challenge roit selfe any such operation. For all *positiue* effects, proceed

Definition
Left

out of positive causes; neither can it be imagined that this Attraction should grow out of a meere *privation*. Secondly, should this be granted, that the motion of Earthly parts should be from the Attractive vertue of the Center; it would follow necessarily, that this motion should not bee *Naturall*, but *violent*: as proceeding from an *externall* cause, which all ancient and moderne Philosophers deny.

2 *The same point is the center of Magnitude and waight in the Terrestrial Spheare.*

That the same point in the *Terrene* Globe, should make the center both of *Magnitude* and *Waight*, may seeme very plaine: 1 Because we are not to multiply things and Entities in our conceit, without any necessary consequence drawne from Nature or Reason; enforcing vs therunto. But what reason could euer perswade any man, that the Earth had two Centers, the one of *Waight*, the other of *Magnitude*, but only a bare Imagination, without prooffe or demonstration. Secondly, if this were granted, that the Center of magnitude were remoued some distance from the other; then consequently would one part of the Earth ouer-poize the other in ponderosity, and so the whole Spheare would either be shaken out of its place, or dissolue it selfe into its first principles. Both of which being by experience contradicted, our assertion will stand sure and vndoubted. In the meane space, we deny not but that some little difference may be admitted in regard of the vnequall parts of the Earth; but this must needs be so small and insensible as cannot bee calculated, or cause any alteration.

3 The *Terrene* parts conforming themselves to this center, may bee considered two wayes: either *Absolutely*, or *Comparatiuely*. *Absolutely*, as euery part is considered in it selfe.

4 A *terrestrial* part considered in it selfe, vndergoes

dergoes the respect either of a *Point of Magnitude*; as a point, when any signe or point in it selfe is considered in regard of his conformity to the center.

A *Point*, albeit existing still in some magnitude (as we haue shewed) may notwithstanding bee abstracted from this or that body, as seruing for the center of any body, whose naturall inclination and conformity to the vniuersall center of the Earth, we may in the first place handle, as the Rule by which the motion and inclination of the whole magnitude ought to bee squared.

1 *Euery point or center of waighty body, is moued toward the center of the Terrestriall Spheare by a right line.*

A *Right line* is the measure and rule almost of all *Naturall* actions; which albeit it be familiar in almost euery operation; yet most of all in the motion of the Earthly bodies tending to the center of the Earth. Why *Nature* in this kind should chiefly affect a *Right line*, sundry reasons may bee alleaged: 1 From the *End* which Nature doth propose it selfe, which is to produce the worke which shee intends, the readiest and shortest way; as *Aristotle* testifies of her in the 5 of his *Metaphisickes*. Now it is manifest that a *Right line* drawne betwixt the same points, is alwayes shortest, as *Euclide* shewes in his *Elements*; where hee demonstrates that two sides of any *triangle* being counted together, are longer then the third. The better to vnderstand the working of *Nature*, wee shall obserue in the motion of a heauy part to the center, a double scope or end; first, that the said part of a *terrestriall* body, should bee moued or separated from the place to which it is by violence transposed. Secondly, that this body should bee restored home, and vnited to the *Sphericall* substance of the Earth, in which it must chiefly seeke its preservation. That these two ends are best and soonest compassed by a *right line* is most manifest: For first a *separation*

Relis

chick 7
+ 700

paration from the place to which it is moued, is more quicke & expedient by a right line; forasmuch as crooked and circular lines, turne backe as it were into themselves againe. Also the v-nion and coniunction of a part with the *Spheare* of the *Earth*, is most indebted to a right motion, because (as wee haue declared) the way is shorter. Secondly, it may bee alleaged, that *Nature* is an *vniforme* and necessary Agent, restrained to one only bound or end, and therefore can neither strengthen, weaken, remit or suspend the action, but workes alwayes by the same meanes, the same effects; whence it is that she chuseth a right line, being but one betwixt two points; whereas crooked lines may bee drawne infinite, and the motion directed by crooked lines would proue various and opposite to the prescript of Nature. Moreover should wee imagine that nature at any time wrought by a crooked or circular line, it might be demanded, from what Agent this obliquity should arise? not from Nature it selfe: because (as wee said) shee worketh alwayes to the vtmost of her strength, hauing no power to remit or suspend her actions. But a crooked motion ariseth from the remission or slackning of the Agents force, and turning it away from the intended end, which only findes place in Free and *voluntary* Agents. Neither comes this Deflexion from the *medium*, or Aire; because it can haue no such power to resist. Thirdly, if the motion were not performed in a right line, it could haue no opposite or contrary; because (as *Aristotle* teacheth) *To a circular or crooked motion, no other motion can bee opposite or contrary in respect of the whole circle; but only in regard of the Diameter*, which is alwayes a right line. By this it is plaine, that a *weighty point* considered in it selfe abstractly, cannot but be carried to the center in a right line: which right line, *really* and *Physically* points out vnto vs a *Radius* or *Beame* drawne from the center to the circumference, to shew that the God of Nature in composing the earthly globe, both obserued and taught vs the vse of Geometric.

2. — *A point mouing toward the Center, will moue swifter in the end, then in the beginning.*

This hath been plainly obserued by experience, that a *stone* let

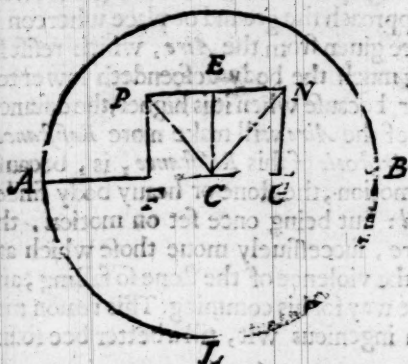
De celo
cap. 4.

let fall from a towre or high place, will in motion grow swifter and swifter, till it approach the ground or place whereon it falls. The reason may bee giuen from the *Aire*, which resist so much the lesse, by how much the body descendeth lower toward the *Earth* or center; because when it is higher, the distance being greater, the parts of the *Aire* will make more *Resistance*. The reason tendred by *Aristotle* of this *Resistance*, is, because in the beginning of the motion, the stone or heavy body findes the *Aire* quiet and fixed: but being once set on motion, the higher parts of the *Aire*, successiueley moue those which are vnder, being driuen by the violence of the stone so falling, and prepare, as it were, the way for his comming. This reason may in some sort content an ingenious wit, till a better bee found out.

IO So much for the motion of a heavy point or center: it remains that we treat next of the motions and conformity of *Magnitudes* to the center of the *Earth*: wherein we consider not only the *Center* or middle point, but the whole masse of the magnitude, whose motion and conformity shall bee expressed in this Theoreme;

I *The motion of a magnitude toward the center, is not meerely naturall, but mixt with a violent motion:*

This may easily bee demonstrated; because no point of any magnitude is moued to the Center naturally, but the middle point or center of the magnitude: For although the Center bee moued in a perpendicular line, which makes right angles with the Horizon; yet the extreme parts are moued in lines parallel, which cannot possibly make right angles with the Horizon, or meet in the Center; which may bee showne in this Figure.



gure. Let there bee a Circle as *AB L*. This done, wee will imagine a certaine magnitude hanging in the Aire, and tending to the Center *C*, which is signified by the line *P E N*. It is certaine that the Center of the magnitude *E*, will moue and conforme it selfe downward toward

the center of the Earth by the line *EC*, which motion will bee *naturall*, as that which is deriued to a center from a circumference by the direct *Radius*, which is the Rule of all naturall motions: But the other parts without the center of this magnitude, cannot moue but in so many lines, which shall bee *parallel* the one to the other: as for example, the point *N* must needs moue in the line *NG*, and the point *P* in the line *PF*, which being of equall distance, will neuer concur in the Center, and therefore cannot bee esteemed naturall rayes of the circle; whence wee may collect, that the motion of these parts is not *naturall*, but *violent*: for if any should imagine the motion of these parts to be naturall, then should the point *N* moue to the center of the Earth by the line *NC*, and the point *P*. by the line *PC*; and so by how much the more any waighy body should approach the Center of the Earth, by so much it should bee diminished and curtailed in his quantity: so that in the Center it selfe, all the parts should concur in an *Indivisible* point, which is absurd & contradicts all reason.

¶ Hitherto haue we spoken of the conformity of all Earthly and waighy bodies to the Terrene center, as they are taken *Absolutely*. It
now

now remains that we speake of these bodies as they are taken *comparatiuely*, being compared one with the other.

This discourse properly belongs to an art which is called *Staticke* and *Mathematicall*; whose office is to demonstrate the affections of *Heauinesse* and *Lightnesse* of all Bodies out of their causes. The chiefe sensible Instrument whereon these properties are demonstrated and shewne, is the *Bilanz* or *Ballance*. But these specialties wee leaue to such as haue purposely written of this subiect: amongst which the most ancient and chiefe is *Archimedes*, whose heauenly wit ouertooke all such as went before him, and out-went all such as followed. Enough it will seeme in this Treatise to insert a proposition or two *Staticall*, to shew the *Conformity* of two magnitudes, and their proper Center, mouing downeward toward the Globe of the *Earth*, and it's Center.

1. *The lines wherein the centers of two heauy bodies are moued downeward, being continued, will meet in the Center of the Earth.*

A heauy point or Center (as wee haue demonstrated heretofore in this Chapter) is moued toward the Center of the world in a right line, which is imagined to bee a *Ray* of the whole Spheare deriued from the circumference to the Center, & therefore it is impossible they should bee parallell or Equidistant, but concurrent lines. But because the whole distance betwixt vs and the Center is very great; it must needs happen that in a small space the concurse of perpendicular lines is altogether insensible. For if two perpendicular or heauy points moued in a line, should be distant one from the other the space of 10, a 100 or more feet; because this distance is very little in respect of the *semidiameter* of the *Earth*: the angle of concurse must needs be very little, and by consequence those two rayes or lines, measuring the descent of two heauy Bodies, will seeme altogether *Equidistant*. Yet that there is such a concurrence, *Nature* and
Reason

Reason will easily consent. Hence wee may detect a popular error beleecued of the vulgar, that the walls of houses standing vpright are *parallel* and of equall distance; when contrariwise it is plaine that such walls are erected by a *perpendicular*, and measured by perpendicular lines, which being drawne out in length will meet in the Center of the Earth. The like may we pronounce of a deep *Well*, whose sides or wall are erected perpendicularly; and therefore should it reach as farre as the Center, it must needs follow that the sides growing neerer and neerer as they approach the Center, would in the end close or shut vp into a *Pyramide*, whose *Base* should bee the mouth of the Well. Likewise if a Tower should bee erected to the Heauens, it would be strange to imagine, how great and broad the vpper part of it would bee in respect of the bottome. Hence againe it may be inferred, that any pauement leuelled by a perpendicular is not an absolute plain, but rather the *portion* or Arch of a *spherical* superficies, whose Center is the same with the Center of the whole Earth. But this roundnesse in a small distance is no way sensible: but in a great pauement of foure or siue hundred paces leuelled perpendicularly; it will make some shew of roundnesse: whence it must needs follow, that an extraordinary great pauement measured ouer by a right line, cannot be called leuell or equally poized, forasmuch as it is not euery where equally distant from the Center of the Earthly Globe.

2 *Two heavy bodies of the same figure and matter whether Equall or Vnequall, will in equall time moue an equall space.*

This proposition being inuented by one *Iohannes Baptista de Benediktis*, is cited and confirmed by *John Dee*, in his Mathematicall Preface to *Billingstie's Geometry*; Which corrects a common error of those men, which suppose the lighter bodies generally not to moue so fast downeward to the Center as the heauy. The demonstration of this Theoreme, being drawne from many *Staticall* principles, which we cannot here conueniently insert, wee are enforced to omit: as intending not the search of these matters any farther than they direct vnto the knowledge of

of *Geographie*. Yet were it no hard matter to giue a more popular expression of this reason out of the proportion betwixt this weight of the heavy Body, and the Resistance of the *Aether*. Because the Greater Body, as it is carryed down-ward by a greater force and violence; so on the other side it meets a greater impediment, being not able so soone to diuide the Aire, as the Lesser. Likewise the Lesser body falling with lesse force, yet is more apt to diuide it then the other. Whence both set the one against the other, there will be no disparity in the time and motion.

Democritus

12 Of the *primary* conformity of the Terrestriall bodies in the constitution of the Terrestriall Spheare, wee haue treated: It now seemes needfull that we descend to the *secondary*, which is the inclination of all the parts, to make a round Spheare or Globe.

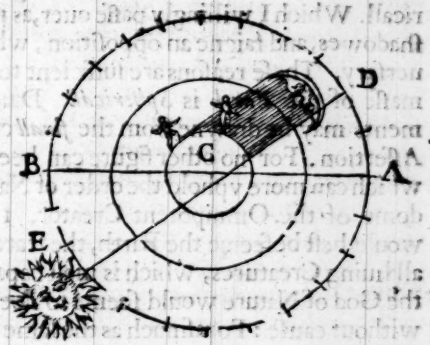
1 The Terrestriall Globe is round and Sphericall.

This Proposition is of great vse, and one of the chiefest grounds in *Geographie*. The ground of the Sphericall figure of the Earth, is the right motion of heavy bodies to the center. For this right motion (as wee haue shewed) doth expresse one Beame of the circle, by whose circumuolution is procured the circumference of it, which we call *Secondary conformity* of the parts of the Earth: in so much as it growes *Mathematically* (as it were) out of the first. For this Sphericall figure of the Earth, sundry sound reasons are vrged by *Geographers*: First, that the Earth is round according to its *Latitude*, that is, from North to South. Secondly, according to its *Longitude*, that is, from East to West, and therefore must it needes bee absolutely Sphericall. The first part is shewed, that it is round from North to South: for if a man trauell from North to South, or contrariwise from South to North, hee shall perceiue new starres in the Heauens to appeare and shew themselves, which before hee could

L. de Sphar.

could not see: which can be referred to no other cause then the Sphericall connexity, or swelling of the Earth. As for example; The starre which is called *Canopus*, which is a notable starre in the ship; appeares not at *Rhodes*, or at least from high places. But if you trauell forth Southward from *Italy* into *Egypt*, to *Alexandria*, the same starre (*Proclus* obserues) will manifest it selfe to your sight the fourth part of a signe aboue the *Horizon*. From whence wee may draw a sound prooffe, that there is a Sphericall and gibbous connexitie, which interposeth it selfe betwixt *Rhodes* and *Egypt*. In which place, the people who inhabite that part of *Egypt*, which borders vpon *Arabia*, which are called *Troglodites*, of their dwelling in caues, cannot see any Starre of the *Great Beare*. Whence wee may conclide, that the Earth from the North to the South, is round and Sphericall. For if otherwise the Earth were *plaine*, all the Northerne starres would appeare to the inhabitants of the Southerne Regions; and on the other side, all the other Southerne constellations would bee seene of the Northerne inhabitants, which sense and reason altogether contradict. Secondly, that the Earth is round according to its *Longitude* betwixt East and West, may bee proued by two reasons. The first is taken from the rising and setting of the *Sunne*, *Moone*, and other Starres, for as much as all they doe not arise or set with all Nations at the same houres. For with the inhabitants of the East, the Sun-rising is sooner; with the Western inhabitants later; and that in such proportion, that euery 15. degrees measured out by the Summes diurnall motion, adds or subtracts one whole houre in the length of the day. This is found by experience and testimony of *Cosmographers*, that the *Sunne* riseth with the *Persian*, inhabiting toward the East, foure houres sooner then to the *Spaniard* in the West. Sundry other the like examples may bee alleaged; all which we must needs impute to the Sphericall roundnesse of the Earth, proportionally increasing betwixt East and West. The other reason to confirme this last point, is drawne from the *Eclipses* of the *Sunne* and *Moone*, which would not appeare in diuers places, at diuers houres, if the Earth were *plaine* or square. We see plainly that *Eclipses* of the *Moone* appeare sooner to the Western

Western people, but later to the Eastern. As (according to Ptolemy) in Arbela a towne of Assyria (where Alexander overcame Darius the last King of the Persians) was there observed an Eclipse at the fifth houre of the night, which selfe same Eclipse was seene in Carthage at the second: which to any man appears plainly in this figure here inserted. In like manner an Eclipse of the Sunne at Campania which was observed betwixt 8 and 9. was (as Pliny reports) seene in Armenia betwixt 10 and 11 of the clocke. Whence may be gathered that this difference of appearance arose from the roundnesse of the Earth, interposing it selfe betwixt these



Lib. 2. c. 72.

two places. Another reason to proue the Spherical figure of the Earth, is drawne from the Eclipse of the Moone, wherein the obscured point is described by a Spherical figure, which must needs argue, that the body which causeth the shadow, is also round. For as the Optickes teach vs, the shadow is wont to follow and imitate the opacous body whence it proceeds, and all men confesse that the Eclipse of the Moone is made by the interposition of the Spheare of the Earth betwixt the Sun & Moone, intercepting the beames of the Sun, which should illustrate & lighten the Moone. The third reason may be taken from the absurdities which would follow, should we admir any other figure besides. For granting it to be plaine (as some of the Platonists haue imagined) it would necessarily follow in reason; 1 That the Elevation of the Pole would bee the same in all the parts of the Earth. 2 That there Would bee the same face and appearance of the Heauens in all places. 3 That the Sunne and Moone, with other starres, would in all places arise alike at the

same houres. 4 That all *Eclipses* would appeare to all places at the same houres. 5 That the same *quantity* of dayes & nights would bee at all places. 6 That the *shadows* would bee euery where alike; and one Region would not bee hotter or colder then another; all which would plainly stand opposite to reason and experience. As many or more would proue the absurdities of those, that ascribe to the Earth any other figure then Sphericall. Which I willingly passe ouer, as not willing to fight with shadows, and faigne an opposition, where I scarce finde an aduersary. These reasons are sufficient to proue, that the whole masse of the *Earth* is *Sphericall*. Diuers other popular arguments may be drawne from the small cause to countenance this Assertion. For no other figure can bee assigned to the Earth, which can more vphold the order of Nature, or speake the wisdom of the Omnipotent Creator. 1 Because such a Figure would best becom the Earth, the seate and dwelling-place of all liuing Creatures, which is most capable & because otherwise the God of Nature would seeme to doe something in vaine, and without cause: Forasmuch as the same capacity might bee confined within stricter bounds. Now it is apparant to all *Mathematicians*, that amongst all those figures which they call *Isoperimetrick*, a Circle is the most capable, and amongst the rest, those which approach nearest vnto a circle. And as wee esteeme of a circle described in a plaine surface, so must we iudge in *solides* of a *Sphere*. Which profitable Geometry of Nature wee shall finde instilled into most liuing Creatures, who by a certaine *Naturall Instinct*, without the vse of Reason, make their Nests and resting-places of a *Sphericall* Figure, as most conuenient, and of greatest capacity; as experience shewes vs; in the Nests of Birds, and Bee-Hiues, wherein the cells are fashioned round & Sphericall. 2 We shall finde the holy Scriptures consonant to this opinion in diuers places; but that it might seeme impiety to vse those sacred helps in a matter out of controversie, and needing no such Demonstration.

2 The rugged and vnequall parts of the Earth, hinder not the Sphericall roundnesse of it.

It is thought by ignorant people, that the Earth is not round, because of the rugged and vneuen parts of the superficies of it: For some-where it swells with great and high mountaines, rocks, and hills; Other-where it seemes indented, and (as it were) trenched into valleyes, & concauities; all which seeme to detract from a true Sphericall superficies; because in such a one, euery line drawne from the Center to it, should bee equall one to the other. Indeed that the Globe of the Earth is not Absolutely and Geometrically round, as an Artificiall Spheare, is confessed by *Eratosthenes*, cited by *Strabo* in his 1 booke of *Geographie*: whence *Pliny* in his 2 booke, cap. 21, saith, that the Earth & Water make one Globe, not so absolutely round as the Heauens, but much deficient, as also *Strabo* confirms. This proposition depending on these 3 reasons which follow, will shew that this Inequality, how great soeuer it seeme to the sight, is altogether insensible, and bearing no proportion with the huge vastnesse of the whole Earth. The first is taken from the perpendicular height of the greatest and highest mountaine, which is seldome or neuer found to exceed 10 miles; (although few Mathematicians will grant so much) whereas the whole Diameter of the Earth containes no lesse then 7200 English miles; so that these hills compared to the thickness of the Earth, are but as 10 to 7200: which indeed hath no sensible proportion. The second is taken from the Eclipse of the Moone, which being caused by the shadow of the interposed Earth, is described by a Sphericall figure, without any vnequall or rugged parts, which no doubt, would appeare, if these parts challenge any due proportion, or sensible quantity, in respect of the whole Earth. Thirdly, some haue illustrated this by a round bowle, or ball, whose externall surface, although vnequall, and indented here & there with scotches, other-where swelling with knobs, will notwithstanding being interposed betwixt the Sun-beame and a wall, or such place, giue a round or Sphericall shadow in the same wall or plaine, in regard of the little quantity of these small parts in respect of the whole Body. In like sort must wee imagine the mountaines and vnequall parts in the face of the Earth, to bee no otherwise then as so many warts or pimples in

Lib. I.

the face of man, which cannot alter his due proportion or symmetry of the parts.

7th of 1. 1. 1. 1727

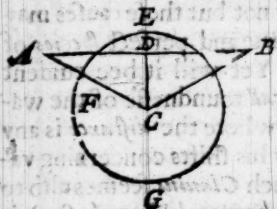
3 The Water concurring with the Earth in the Globe is also Spherisall.

It is a proposition agreed on by *Archimedes*, and almost all the ancient *Mathematicians* of any note, that the superficies of the Water, or any other liquor, standing and subsisting quietly of it selfe, is *Spherisall*; whose center will bee the same with the center of the whole *Earth*, which we are here to handle, because it appertaines to the making vp of the *Terrestriall Globe*, although wee shall have occasion hereafter to speake specially concerning the *Water* in *Hydrographie*, in the second part of this Treatise. The reasons to confirme this assertion, beside those that in generall proue the *Sphericity* of the *Terrene globe* are diuers: 1. It is obserued that *Passengers* in a *Ship*, lanching out into the deepe from some *Hauen*, will first perceiue the *Towers*, *Buildings*, *Castles*, *Promontories*, and *Trees* standing on the land, in their perfect figure and greatnesse: sayling farther off, they will obtene them on the lower part, little & little diminished, vntill such time as the tops only of the houses and trees will bee visible. In like sort they which tarry on the Land, will first espye the top and mast of a *Ship* approaching, which sight will bee perfected more and more, as the *Ship* drawes toward the land, and at last all parts of it will shew themselves; which accident can bee cast vpon no other cause, then the *Spherisall roundnesse*, and swelling of the water; which, if the distance be great, interposeth it selfe betweene the station on the Land and the *Ship* wherein *Passengers* are conuoyed, which experiment is expressed in this Diagramme here annexed. Certaine *Platonicks*, of which the chiefest is *Parricius* a late Writer, would ascribe this.



this experiment to the impediment of the sight, caused partly by the distance which cannot perfectly represent the object, partly by the interposed vapours arising in the Sea; partly by the quivering light which is spread by the refraction of the Sun-beames in the water. I deny not but these causes may somewhat hinder, and cause that the true and perfect species of a body cannot alwayes visit the sight. Yet will it bee euident that this is not all, but that the *Spherical* roundnesse of the water will proue a greater impediment where the distance is any thing greater. But for one of *Parricius* his shifts concerning vapour arising out of the Sea, (to which *Clauius* seemes also to consent in his Commentary vpon *Iohannes de Sacrobosco*) it makes more for our assertion then his. For that which is seene in a thicke *medium*, according to the doctrine of the *Opricks*, seemes greater in quantity, and by consequence neerer, and so higher then would otherwise appeare: as wee see by experience, that the *Sunne* sometimes is seene of vs before it ascend about the *Horizon*, because of a refraction of it's beames in a thicke matter. Wherefore it were rather to be imagined, that a tower seene at Sea, or a ship from the land, through these thicke and grosse vapours, should appeare higher, and seeme neerer then if it met not with such vapours. Secondly, what is vrged concerning the trembling light, caused by a refraction of the Sun-beames in the water, is of no force: For althoug such a light might cause an impediment or hinderance to the sight; yet would not this decrement or hinderance bee by degrees and in such proportion as we find it to be correspondent, to wit, to the distance interposed. And much wonder it is that *Parricius* (as my learned Friend Mr *R. Hues* obserues) being, as it seemes very well read in the stories of *Spanish* nauigations, shou'd not bee conuincid out of the Nauigation of *Magellane*, who taking his journey toward the *Southwest* parts, passed by the *Magellane* straights, now called by his name, and so returned by the *Cape of Good Hope* into *Spain*, to which wee may adde the voyages of *Drake*, *Candish*, and many others. The second reason is vrged by *Aristotle* in his 2^d booke de *cælo*, and hath its ground in *Archimedes* lib. 1. de *Aqua-vestitu*, which is formed in this

fort. The nature of the water is to affect and flow to the lower place, whence it must necessarily bee inferred that it must bee round, for otherwise it should not alwayes obtaine the lower place. The reason of the consequence shall bee expressed in this



figure; for if we ascribe to the water a plaine superficies; let it for example bee ADB , and from the center of the earth C let there be described a circle, to wit, EFG ; then let there be drawne CD , a perpendicular line to AB , and let AC and BC be ioyned together.

Now because the right line CD is lesse then CA , or CB , as will appeare evidently by sense; it will be plaine that the point D will be in a lower place then the point A or B , because D is neerer to the Center; for as much as DC is but a part of a beame of the circle whereas AC and CB evidently exceed that quantity or proportion. Another reason there is, commonly drawne from the roundnes of drops cast on the sand, as also from water in pots, whose superficies seemes to swell about the brimmes; but this reason, as we shall prone in place convenient, is rather against this assertion then for it; because indeed, wee affirme the water to be round; but so as it claimes the same *Curve* with the Center of the *Terrane* Globe; and therefore cannot be sensible in so little a portion, as a drop, or pot of water. This proposition being sufficiently proved by these two reasons; it is needfull in the second place that wee answer certaine objections cast in by the said *Patricius* against our assertion. Every surface of the water (quoth *Patricius*) is either only plaine, or only round, or both plaine and round, or neither plaine nor round. First that it is not both plaine and round, seemes very evident, for so it should admit of *contrariety*: Neither can one part be plaine and another round, because the water is an vniforme and homogeneous body, not consisting of such vnequall parts: that it should neither bee plaine nor round seemes more impossible, because few or none haue dreamt of any other figure. Lastly, that it is not round only, hee labours to confirme by sundry rea-

sons

sons and experiments. First, he testifies of himselfe, that sayling in the Sea, he plainly saw in the morning before Sun-rising, the Mountaines of *Corfu*; which after ward, as soone as the Sunne was risen, vanished out of his sight. Whence he concludes, that this proceeds not from the roundnesse of the Earth, but from some other cause. But this argumēt to iudicious men will seeme very weake, 1. Because it depends altogether on the authority and credit of *Patricius*; whose assertion I take to bee no better then another mans deniall. 2.^{ly} were this argument every where found, yet would it proue no other thing, but that this effect were not to be imputed to the Sphericall swelling of the Earth. Whence cannot bee drawne any generall conclusion, that the *Earth* or *Water* is not *Sphericall*. Wee deny not in the meane time, that other causes sometimes concurre, which may hinder or take away the sight of objects from those who saile on the Sea. The second experiment, *Patricius* describes in this manner. At a certaine Towne called *Comaculum* (saith hee) there is a very great poole; through which poole or lake some 3 yeares agoe, it was my chance to bee carried in a boat. The bottome of the water almost all the way in all the journey appeared to bee lesse then 2 foot in depth from the top. The way increasing, at first the lower parts and foundations of houses, then the tops and princely pinnacles began to vanish from our sight: at last having scarce passed 6000 paces, a Tower 72 foot high began to appeare; as it were cut off by the middle, and from the middle part upward appeared visible; but after 10000 paces it was taken out of sight: I would here aske the *Geographers* (quoth *Patricius*) whether in so short a distance, wherein the bottome for the whole space surpassed not two foot in depth, the water could ascend to 72 foot? Had it beene my chance to haue gone with *Patricius* over the lake, I might perhaps by obseruation of this experiment, haue giuen a more probable coniecture of the cause. Neuerthelesse being vnacquainted as well with the place, as the truth of his obseruation, I may perhaps guesse somewhat at his errour. First then, whereas hee auerres, that passing along for the space of a 1000 paces, a Tower of 72 foot high, seemed cut off by the midst, which at 10000 vanished out

out of sight. I confesse that in so short a space the swelling of the water inter-posed, could not be so great as to hinder the sight, and bee the cause of this effect: wherefore some other *Accidental* cause must bee sought out. For the finding out of which to come as neere as I can, I would make inquiry, whether this passage of the *Boat* was directly forward from the Tower on the Water, no land inter-posed: or *Indirectly* side-wise, in such sort, as the shoare might be placed betwixt their sight and the Tower mentioned: The former no wayes can be imagined; for as much as it not only contradicts the grounds of our received *Philosophie*; but also of *Patricius* himselfe: for giuing the Earth a *plaine* surface, or *Angular*, or any other forme, it were impossible that in so short a distance, such an effect should happen out of the figurature of the water. If the passage were *oblique* or indirect, in such wise as the shoare might any way inter-pose it selfe betwixt the *Boat* and the *Tower*, it were easie to imagine how such an experiment should happen: for the land by which the *Boat* might bee carried, might haue an ascent by such Degrees, as the Tower at 1000 paces might bee for the halfe of it obscured, and at last bee altogether taken out of sight. This reason then of *Patricius*, seemes rather to bee ascribed to the Land then the Water. The third reason of *Patricius* is drawne from the *Homogeneity* of the Water. If the water (saith hee) haue a round *superficies*, the parts of it would challenge the like figure, because in *homogeneous* bodies, the same reason is to bee giuen of the *whole*, and of the *parts*: But the parts of the water are not Sphericall, as may bee proued by diuers instances: 1 Because water in the mouth of a pot, seemes not to haue any such *Sphericall* roundnesse: for although at the brinke it seeme to bee restrained about the pot, yet no such swelling appeares in the middle. 2^{ly} That riuers are kept in by their bankes, which otherwise would flow abroad. 3^{ly} That riuers, when by the melting of snow, they swell so great, as they can hardly bee contained within their bankes, doe not seeme higher in the middle, then in other places. 4^{ly} If any man from one side of the riuer to the other, leuels at any marke, he may surely hit it: which hee should not doe, if there were any Sphericall swelling in the midst,

midst, which might hinder the sight. 5^{ly} and lastly it seems so unlikely, that the water should rise in the midst, that it is more probable it should be more hollow; in that we plainly observe that all filth and rubbish carried from the banks into the river, is wont to settle and swimme in the midst. Notwithstanding all these arguments of *Patricius*, our ground is yet vnshaken; 1 Concerning small drops, and water in the mouth of pots; it is found to be round and Sphericall, though not exactly: the reason whereof wee shall declare hereafter. This roundnesse, I confesse, serues not any way to the confirmation of this assertion, because the *Sphericity* and roundnes which wee auerre to be in Water, hath for its center, the center of the whole Earth: and therefore in so small an arch or section, as the bredth of a pot, or a drop of water, cannot possibly haue any sensible appearance or existence. And we must needs confesse, that this experiment was very fondly vrged to this purpose by some of our *Geographers*, and such as stands not with any demonstration. Which granted, sufficiently answers all the reasons last vrged by *Patricius*, except the last. For as much as he requires in the Water, a sensible appearance of this roundnesse in euery river or little parcell of water, which cannot bee admitted. Touching the last thing which hee vrgeth, that all the rubbish and filthy matter, is from the banks carryed into the middle, whence he would inferre the middle to be hollow and lowest; we can answer diuers wayes: 1 That this experiment is not alwayes certaine, because euery man may oftentimes see the contrary; to wit, that such filthy rubbish rather vseth to cleaue to the banks of the river, then to float into the midst. 2^{ly} That if any such thing happen, it is because of the torrents which run violently from the banks into the midst, carrying with it such things as are light, the steepnesse of the place being greater, the current wider or swifter. But nothing here can bee concluded to proue the water according to his naturall force, to be either plaine or hollow in the midst, which this Adversary vndertooke to demonstrate.

C H A P. III.

Of the Partiall magneticall affections in the
Spheare of the Earth.

I **H**itherto haue we discoursed of such affections of the Terrestriall Spheare as are *Elementary*, and knowne heretofore to ancient Philosophers : It followes in the next place that we treat of *Magneticall* affections, to wit, such as follow the magneticall nature of the Earth.

Of the *verue* and propriety of the *Load-stone* many haue written, but few sought out the true nature. The inuention of it is attributed to a certaine heards-man, who hauing his shoes shod with iron, and an iron-pike in his hand, resting himselfe on a quarry of *Load-stone*, could hardly remoue himselfe fro thence. But this seemes rather a pleasant *Poeticall* inuention, then a true History, hauing no good Author to touch it. But to let passe the first Inuention, being a matter rather indebted to *chance* then *industrie*; no small difficulties haue discovered themselves in the inuention and finding out of the causes of *Magneticall* properties. Somewhat, I cōfesse, hath been written of such magneticall affections as haue been most knowne; such as is the vertue *Attractiue*, by which it drawes to it selfe iron, or Steele; as also the vertue *Directiue*, by which a needle touched with the *Magnet*, directs and conformes it selfe North and South. The rest of *Magneticall* proprieties I find in ancient Writers, as little knowne as their causes; & if any matter herein were broached, it was merely coniecturall, and depending on no certain demonstration: neither had we any certaine or satisfactory knowledge
of

of this thing, vntill such time as it pleased God to raise vp one of our Countrymen *D. Gilbert*, who to his euerlasting praise hath troden out a new path to *Philosophy*, and on the Loadstone erected a large *Trophee* to commend him to posterity. This famous Doctor being as pregnant in witty apprehension, as diligent in curious search of naturall causes: after many experiments, and long inquiry, found the causes of most magneticall motions and proprieties hid in the magneticall *temper* and constitution of the *Earth*, and that the Earth it selfe was a miere *Magneticall* body challenging all those proprieties, and more then haue expressed themselves in the Loadstone. Which opinion of his was no sooner broached, then it was embraced and well-commended by many prime wits, as well *English* as *Forraine*. In so much that it hath of late taken large root, and gotten much ground of our *vulgar Philosophie*: Not that in the maine scope and drift of it, it contradicts or crosses all *Peripateticall* principles, or the most part of such grounds as haue hitherto borne the stampe as well of *Antiquity*, as of *Authority*: But that it hath brought to light matters of no small moment, which neuer found any ground or footsteps in our ordinary *Philosophie*. This new *Philosophie* I dare not commend as euery-where perfect and absolute, being but of late yeeres inuented, and not yet brought to mature perfection: yet would it saueur of little ingenuity or iudgement in any man, peruersely to deny all such *Magneticall* affections in the Earth as are grounded on plaine experiments and obseruation, sith no *Philosophie* was euery way so exact, but required experience daily to correct it. I intend not here an absolute discourse of *Magneticall* Bodies and Motions; but leave it to their search whose experimentall industrie is more suteable to such a subject. Onely I will shew some generall grounds appertaining to the constitution of the *Terrestrial Globe*, which I hold necessary for a *Geographer*. Wherefore ete I curiously distinguish these *Magneticall* proprieties of the Earth into other seuerall kindes, I will set downe this Theoreme, as a ground or foundation of that which followes.

1 The Terrestriall Spheare is of a Magneticall nature and disposition.

A Magneticall Body by some is defined to bee that which seated in the Aire, doth place it selfe in one place naturall, not alterable. This situation is supposed to agree to all the Starres, especially to the great Globes of *Saturne*, *Iupiter*, *Mars*, and the *Sunne*; as also to such as giue their attendance on them, lately detected by the Trunk-spectacle; to wit, those two Starres which moue about *Saturne*, the foure which moue about *Iupiter*, the two which circle about the *Sunne*, as *Venus* and *Mercurie*; and lastly the *Moone*, which encompasseth the Spheare of the Earth. But to let passe those other Globes, as farther off, and therefore lesse subiect to our search: our discourse shall only touch the Earth whereon wee liue, which wee shall proue to partake of a certaine Magneticall vertue or inclination: which to shew more openly, we must vnderstand, that all Magneticall Globes haue some parts of their bodies which bee also Magneticall, which being diuorced from their proper Spheare, & meeting no obstacle, will settle themselues to the naturall situation of their peculiar *Orbes*. Which wee may plainly perceiue in the Spheare of the Earth, wherein wee shall find two Magneticall minerals; whereof the one is the *Load-stone*, attracting iron or Steele; the other the *Iron* or Steele it selfe: either of these two, artificially hanged in the Aire, or placed in a little boat on the water, all incommbrances being remoued, will conforme & settle their *parts* and *Poles* correspondent to the poles and parts of the Terrestriall Spheare, as *North* and *South*. This hath been found in all parts of the Earth by such as haue trauelled round about her, as *Drake* and *Candish*, whose Compasses were alwayes directed Magnetically in all places which they passed: which we cannot ascribe to any other cause then the *disposicion* faculty of the Earth's Magneticall Spheare, as shall appeare hereafter by demonstration. Moreouer it hath been obserued by such as saile *Northerly* and *Southerly*, that the Magneticall *Inclinatory* needle, in euery eleuation of the Pole is conformed and disposed to the Axell of the Earth, according to certaine angles answerable to

to the latitude of the Region, as wee shall shew hereafter. This diversity of conformity must necessarily arise, either from the *Magneticall* instrument in it selfe *absolutely* considered, or els from the *Harmony* and correspondency it hath with the Terrene Globe. It cannot be the first; because it should bee the same in all places and Regions of the Earth, which is contrary to experience, and our supposition. Then must wee needes deriue it from the *Magneticall disponent* vertue of the whole Globe of the Earth, from which vertue the whole Earth may bee called *Magneticall*. Nay if we truly consider, these *Magneticall* affections *primarily* agree to the Earth, as the mother of all *Magneticall* bodies; but afterward *secondarily* are deriued into the parts; because (as *Gilbert* relates it) the cause of *magneticall* motions and affections is the *magneticall forme* of a *Spherical* Globe; which forme first agrees to the whole Globe of the Earth, and so is deriued to all his *homogeneall* parts. These parts are called *Homogeneall*, not in regard of their *Matter* and *quantity*, but in respect of their *Magneticall nature*, and *communion*, which in euery part is conspicuous. If any man should wonder why the Earth should bee called *Magneticall* in regard of this minerall, which seemes one of the least and scarcest substances whereof it consisteth; we may many wayes answer. First, that although the surface of the Earth seemes for the most part composed of other materials, more conuenient for the vse of living Creatures which dwell therein: yet may infinite rocky mines of Magnets be couched lower toward the center, which strengthen and consolidate the Earthly Globe. Secondly, wee must not imagine the *Magneticall* substance of the Earth, to bee all one kinde of stone, but various: for somewhere it is hard & solide as the true magnet it selfe and the iron which is nothing els but a metall decocted out of the Load-stone; (for iron *ore* differs little or nothing at all from the *Load-stone* it selfe) somewhere againe, this substance is more thinne and fluid, being it selfe conected as some kinde of *clay*, and certaine vapours arising out of the Earth, which bee *magneticall*: which being brought to a harder and more massie substance, will haue the same affections and motions with the Loadstone it selfe. This

asserti-

assertion of the Earth's magneticall nature, wee shall confirme more euidently hereafter, where we shall proue both the *Poles*, the *Meridian*, *Parallels*, and other circles, to bee not bare *Imaginary* lines, as some haue thought (but to bee *Really* grounded in the magneticall nature of the Earth, and are to be shewed in any round Loadstone, wrought and placed conueniently with instruments thereunto applied.

2 The Magneticall affection of the Earth is twofold, either *Radicall* or *Deriued* The Radicall disposition we call that which is the first root and ground of all other magneticall motions.

3 The Radicall vertue or inclination is againe twofold, either *Motiuie* or *Disponent*. The Motiuie is that by which all magneticall bodies are inclined and stirred vp to the motion.

In the *Reasonable* soule of a man, wee haue two faculties which shew themselves; a *motiue*, and a *directiue* or *disponent* power: whereof the one stirres vp the motion, the other regulates, conformes, and directs it: The former is the *Will*; the later the *Discourse* and Iudgement. This distinction of faculties, how-soeuer more euident in the soule, findes place in all *Naturall* agents: in which a Philosopher ought to distinguish betwixt that which giues them a power to moue, and that which limits, determines, and (as the Schoolemen are wont to speake) *modifies* the action. Amongst others the magnet-stone seemes most to partake of these two powers, as that which amongst all naturall agents (in *Gilberts* opinion) seemes most to haue resemblance with the soule of a man: so that by an apt Trope it hath been called of many, the Magneticall soule of the Earth; for hence wee may well perceiue one vertue or inclination, which causeth the magneticall needle to moue out of its place; and
ther

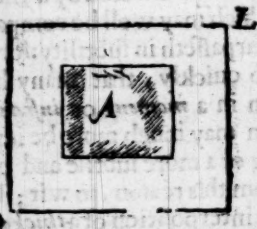
Other by which it is apt to conforme it selfe North and South, as also to obserue certaine angles correspondent to the latitude of the place, as shall bee demonstrated in due place. Of the motiue power we will produce these Theoremes.

1 *The Magneticall motion is excited in a small & vnperceiuable difference of time.*

This proposition may be shewed out of euident experiment, wherein euery mans sight may be a witnes. For if an *Iron-needle* touched with the Loadstone, be placed within the Spheare of the magneticall vertue of the stone, it will presently moue it selfe, notwithstanding the interposition of solide bodies, which made *Gilbert* to imagine this motion to bee effected by a meere *spirituall* and *immateriall* efflux, which may well be compared to the *light*, which neuerthelesse it surpasseth in subtilty: for the light is moued from East to West so quickly, that many haue thought this motion to haue been in a *moment* or *instant* of time. But this quicknes of motion may much more be imagined in the Magneticall vertue, being of a more subtile and piercing nature, as may bee gathered from this reason, to wit; That the light is alwayes hindered by the interposition of a *thicke* and *opacous* body; but the vertue Magneticall findes a passage through all solide bodies whatsoeuer; and meets with no impediment.

2 *This Motiue quality is Spherically spread throughevery part of the Magneticall body.*

Here againe may wee finde a great resemblance betwixt the magneticall vertue and the *light*; for as all light Bodies, as the *Sunne*, *Moone*, and *Starres*, cast their beames euery way into an orbicular forme: so this Magneticall vigour casts it selfe abroad not only from the center toward the *superficies*, but from the *superficies* outward into the *Aire* or *Water*, where this magneticall body is placed, and so makes vp a Spheare; but yet with this difference, that if the body bee meere and perfectly Sphericall, the Orbe of the magneticall vertue will end in a perfect Spheare, as wee see the magnet *G* to confine his vertue

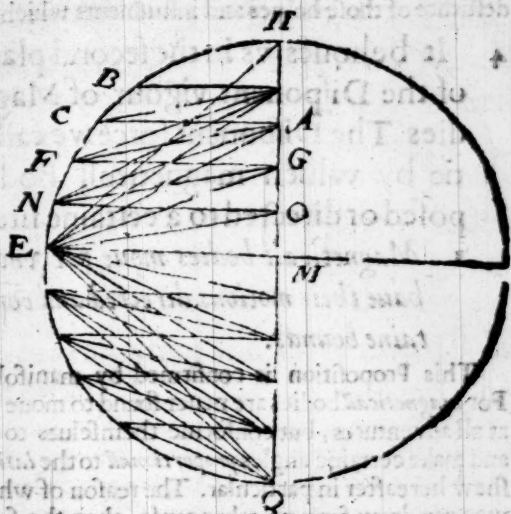


within the Circle B F. But if it be a square, or any other figure not Spherical, it imitates a Spheare as neere as the body will suffer, in that it spreads it selfe euery-where from the center by right lines; yet will it be confined in a square figure correspondent to the body, whence it proceeds, as we see the vertue of the square magnet A, to cast his beames into the square figure L D.

3 The motiue quality of the Magneticall body is strongest of all in the Poles, in other parts by so much the stronger by how much these parts are situated neerer the Poles.

Wee suppose out of the principles of Magneticall Philosophie, that a Magnet hath two Poles, whose vse wee shall shew hereafter. These Poles are found by experiment to haue more force and vigour in them then other parts, and all other parts to enioy more or lesse force, by how much neerer or farther off they are situated to their Poles. The reason is ascribed by these Writers to the disposition of the Magneticall vigour in the body of the Load stone, as shall appeare by this figure following in Gilbert, expressing the great Magneticall Body of the earth. Let the Spherical superficies of it bee H Q E, the Pole E, the Center M: H Q the plaine of the Equinoctiall; from euery point of this Equinoctiall plaine, the vigour Magneticall is conueyed and extended to C F N B; and to euery point from C to E the Pole: but not towards the point B, so neither from

G towards C. The vigour is not strengthened in the part F H G, from that which is G M F E; but F G H doth increase the vertue in H: so that there can arise no vigor so far from the parallels to the Axel-tree above the



said parallels, but internally from the parallels to the Pole. So wee see that from every point of the *Equinoctiall* plaine, the force is deriued to the Pole E. But the point F hath only the vigour from G H, and the point N from O H: but the Pole E is corroborated and strengthened from the whole plaine of the *Equinoctiall* H Q. Wherefore the vigour magneticall in this Pole is most eminent and remarkable, but in the middle spaces; as for example in F, the magneticall quality is so far strengthened, as the portion of the *Equinoctiall* plaine H, can giue. But Dr *Ridley* in his late Magneticall Treatise, in the 6. Chapt. seemes to oppose this Demonstration. For although hee acknowledgeth that the vigour is strongest of all in the Poles; yet (saith hee) if tryall bee made what the Pole will take perpendicularly; and also what the parts about 34 degrees will lift vp, it will appeare to bee halfe asmuch perpendicularly; so that the Pole doth not take vp as much, as this and the other part doth on the other side. But the decision of these differences I leape to such as are more experimentall then my selfe, being

destitute of those helps and instruments which they enjoy.

4 It behoues vs in the second place to speake of the Disponent vigour of Magneticall bodies. The Disponent force we call, that facultie by which magneticall Bodies are disposed or directed to a certaine site or position.

1 *Magneticall bodies moue not vncertainly, but haue their motions directed and conformed to certaine bounds.*

This Proposition is confirmed by manifold experiments. For *magneticall* bodies are neuer found to moue vncertainly, and at all adventures, but conforme themselues to certaine Poles; and make certaine angles *proportionall* to the *latitude*, as we shall shew hereafter in particular. The reason of which experiment wee can draw from no other cause, then the first institution of Nature in all Naturall agents, which wee would haue directed to certaine ends, that nothing in her Common-wealth might seeme idle or vnecessary; wherefore shee giues all agents not only a *power* to worke their ends; but also shewes them the *way*, squares and regulates the meanes which direct vnto the end. No-where is this *directiue* power more remarkable, then in magneticall bodies, especially in their *Direction* and *Variation*, motions treated of hereafter in place conuenient; to which for a further confirmation of the Theoreme, wee referre the Reader.

9 The Radicall facultie of the magneticall body being somewhat spoken of, aswell in their motiue, as disponent vertues. Wee are in the next place to speake of the deriued motions, which arise out of these faculties.

6. These

6 These motions magneticall are either *partiall*, or *totall*. The partiall wee call that by which the parts of the Earth are magnetically moued and conformed as well one to the other, as to the whole terrestriall globe.

7 The magneticall partiall motions are *Coition*, *Direction*, *Variation*, and *Declination*. Magneticall Coition is that motion by which magneticall bodies are ioynd and apply themselves one to the other.

For the knowledge of this magneticall motion, we need goe no farther then the *Iron* and *Steele*, which wee shall obserue to moue vnto the Load-stone, and cleaue vnto it, if so be it bee placed within the Spheare of his vertue. This motion is commonly called *Attraction*, but improperly, as is obserued by D. Gilbert. 1 Because *Attraction* seemes to suppose an externall force or violence, by which one thing is carryed and moued vnto another: but the *Coition* is meere naturall, as proceeding from the internall forme of both the bodies. 2 Attraction supposeth the force of mouing to bee onely in the one party, and the other to bee meere passiue, and not actiue concurring to this motion; whereas in the magneticall coition, both parts are mutually inclined by nature to meet and ioyne themselves one to the other. Not that the force of motion in both parts is alwayes equal: because one magneticall body is greater and stronger then the other, and then the one part seemes to stand still and draw the other vnto it, although there bee in this part so resting an inclination to the other; which mutuall inclination of conjunction in magnets, we may easily see in two magnets of equall quantity and vertue, which being set at a conuenient distance, will so moue, that they will meet in the mid-way. Some haue gone about to parallell this *Attraction* force of the Load-stone with the *Attraction* force of *Ieat* or *Amber*, which wee see by a

naturall vertue to draw vnto it selfe little strawes, and other such like matter. But hee that truly vnderstands the nature of a magneticall body, shall finde a great disparity: First, because the Ieat or Amber which are comprised vnder the name of *Electricall* bodies, drawes vnto it by reason of his *Matter*: whereas otherwise the cause of the *Magneticall Coition* is to bee sought in the *forme*, as being too subtile a thing to spring from a materiall substance. Secondly, *Electricall* bodies draw and attract not without rubbing and stirring vp of the matter first; and presently faile, if any vapour or thicke body should be interposed. But in a magneticall motion wee find no such matter, because it requires no such preparation or rubbing of the stone, nor is hindred by interposition of solid bodies, as wee proue in this place. Thirdly, the Load-stone moues and prouokes to motion nothing els but other magneticall bodies; but the *Electricall* will draw any little thing as straw, haire, dust, and such like. Fourthly, the Magnet will lift a great waight according to his vertue and quantity; but Ieat the smallest and lightest things. Lastly, the *Electricall* bodies, as *Gilbert* well confirms by experiments, draw other bodies vnto them by reason of a *moist* effluence of vapours, which hath a quality of ioyning bodies together: as wee see by the example of two stickes in water at a certaine distance, which will commonly moue till they meet together. But the *magneticall coition* cannot bee other then an act of the magneticall forme. Of the cause of it many Philosophers haue freely spent their vncertaine coniectures, rather out of a feare to bee esteemed ignorant, then of confidence to be accounted learned. Most run vpon the forme of the mixt body, which growes from the composition of the foure Elements; but this opinion is very feeble, and cannot goe without crouches: for sith all mixt formes grow out of the temperament and disposition; they adde nothing to the thing compounded, but diuersly modificate what was before in the simple Elements; it cannot bee imagined how such an affection as this should bee onely found in the magnet, and no other mixt body. Indeed we ascribe this affection to the *forme* as the immediate cause; but by this *forme* we vnderstand not the forme of the *mixture*, resulting out of

of the mixture and temperature of the foure qualities; but the *magneticall* forme of all globous bodies, such as are the *Sunne*, *Moon*, *Starrs*, and this *Terrestriall Sphaere* whereon we live, whose natures receiued the *stampe* in the first creation for the preservation of this integrity. Hee that shall seeke for the originall of all *formes* of this kinde in the *mixture* and *constitution* of the foure Elements, shall labour much, and finde little, and neither at last be able to content himselfe, or instruct others; except wee suppose a man sufficiently taught when hee heares ordinary matters expressed in *exoticke* and artificiall tearmes. For my owne part, I content my selfe with a rule of *Biel* the Schooleman; That when an immediate effect proceeds from an immediate cause, wee ought not to search farther why such a cause should produce such an effect. Euey man being demanded why the fire is *hot*, is ready to flye to the *forme* of fire, and alleage this as the cause: but should hee inquire further, why the forme of fire should bee the cause of heat, hee might perhaps puzzell a whole Academic of Philosophers, and neuer proue himselfe the wiser. For the further illustration of this motion, these Theoremes will seeme necessary.

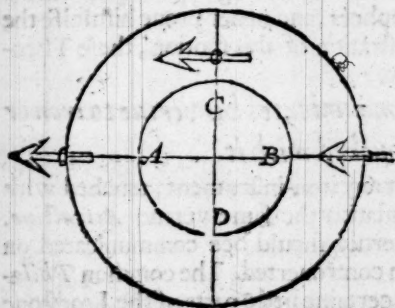
I *The Magnet communicates his vertue to iron or Steele if it be touched with it.*

Experience teacheth that any iron-instrument, touched with the Load-stone, receiues instantly the same vertue *Attractione*. But the manner how this vertue should bee communicated on so sleight a touch, hath been controuerted. The common *Philosophers* haue imagined, that certaine little parts of the Loadstone are separated from it in the touch, which cleauing to the iron or Steele, cause this Attraction. But that this vertue cannot be communicated by any *corporall* processe, or any such little parts cleauing to the iron, is not so easie to imagine: for first it seemes impossible, that with a bare touch, these parts should bee separated from the magnet, or at least should bee so fast linked to the iron. Secondly, these parts being so little and insensible, cannot haue so much vigour as wee see an Iron will haue at the touch of the Load-stone. Thirdly, the Loadstone can worke vpon

the iron notwithstanding any body interposed, which is an evident signe that the iron it selfe is of a magneticall temper. Wherefore to shew a reason of this effect, we say; That *iron* is a metall excoited out of the Load-stone; which albeit it retain in it selfe the vertue of the Load-stone, yet by reason of the liquefaction, is altogether languishing, and as it were buried; but vpon touch of a Load-stone, is stirred vp to his former vigour: for the magnet insinuates his *Incorporeall* influence into the *iron*, and so rectifies and animates that force which was almost dead.

2. *The magneticall Coition is strongest of all in the Poles.*

This may easily bee demonstrated by an experiment: for if the iron needle which is proposed to bee *Attracted*, and the *Poles* and *Center* be placed in the same right line; then this *Coition*



will be to a *perpendicular*, as in A and B, to wit, the *Poles* in the Diagramme: but in the middle space they will obliquely respect and point: and by how much farther off from the *Pole* it is, by so much is this vertue weaker: but in the *Equator* it selfe it be-

comes meereely *parallell* without any inclination at all. To know in what proportion this force is increased or weakened, we must put another ground; That the force of this coition is increased *proportionally* as the chords of a circle: for by how much the least chorde in a circle differs from the *Diameter*, so much the forces *Attractive* differ from themselves. For sith the *Attraction* is a Coition of one body with another, and magneticall bodies are carried by a *convertible* nature: it comes to passe that a line drawne from one Pole to another in the diameter, direct-

ly

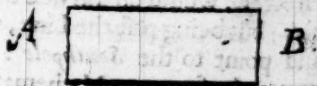
ly meetes with the body, but in other places lesse, so that the lesse it is converted to the body, the lesse and weaker will bee the action.

§ So much bee spoken of the magneticall *Coition*: It followes that wee speake of Magneticall *Direction*, which is a naturall conuersion and conformity of the magneticall bodies to the Poles of the Earth.

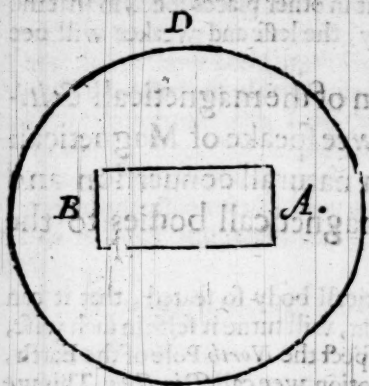
It is manifest that a magneticall body so seated, that it can moue without any impediment, will turne it selfe in such wise, that the one Pole of it will respect the *North* Pole of the Earth, the other the *South*, which motion wee call *Direction*. This we may plainly see in a Marriners compasse, whose *Lilly* alwayes respects the *North* point. If a compasse bee wanting, the same may bee shewed in a little *corken-boate*, which being put in the water with a *load-stone* in it, will so turne and conuert it selfe, that the Poles of the Load-stone will at length point out the Poles of the *Terrestriall* Globe. The manner how, shall be disclosed in these Theoremes.

1 *The South part of the Load-stone turnes to the North, and the North part to the South.*

To confirme this assertion, some haue produced this experiment: Let there bee cut out of a rocke of *Load-stone*, a *Magnet* of reasonable quantity. Let the two poles both *North* and *South* bee marked out in the Load-stone, the manner of which, wee shall perhaps teach hereafter: then let it be put in a corken little boat on the water, so that it may freely float hither & thither: It will be euident that that part which in the rocke or Mine pointed *Northward*, will respect the *South*, and contrarywise the *South* part will respect the *North*; as wee may see in this figure: Let the *Magnet* as it is continued with the Mine or Globe of the Earth be A B, so that A shall be in the *North*



pole.



pole, B the *South-Pole*. Let this Load-stone be cut out of this rocke or Mine, & placed on the water in a little timber boat, which shall be CD: we shall find that this little dish or boat will turne it selfe so long, vntill the *Northpart* A, be turned to the *Southpart* B: and on the other part, the *Southpart* B, be conuerted to the *Northpart* A: and this cōformity would the whole rock of Load-stone claime, if it were diuided and separated from

the Globe of the Earth. The reason why the magnet in the boat on the water, turneth, windeth, and seateth it selfe to a contrary motion to that it primarily receiued, whiles it was ioyned to the bowels of the Earth, and vnited to the body of the great Magnet, is; because euery part of a Load-stone being separated from the whole, whereof it is a part, becomes of it selfe a perfect, compleat, magneticall body. (as we may say) a little Earth, hauing all the properties of the great Globe, as *Poles*, *Meridians*, *Equators*, &c. And therefore according to the nature of magneticall vnion, spoken of in our next Theoreme, will in no wise endure to settle it selfe as it did before; but deemes it a thing more naturall, and of more perfection, to turne his aspect a contrary way, to that which he inioyed at his first constitution. Here may we note a great error of *Gemma Frisius*, who in his corollary vpon the 15 Chap. of his *Cosmographical Comment* on *P. Appian*, affirms; that the Needle magnetically effected, would on this side the *Equator*, respect the *North-pole*; but being past the Line, would straight-way turne about, and point to the *Southpole*: An error (as Mr *Hues* saith) vaworthy so great a Mathematician. But *Gemma Frisius* in some sort,

fort, may be excused; for as much as the grounds of magneticall Philosophy, were in his time either not discovered, or most vnp perfectly knowne, and the vncertaine relations of Navigators were reputed the best Arguments: and how easie a matter it is for a Trauailer in this sort to deceiue a Scholler, who out of his reading and experience can shew nothing to the contrary, let e- uery man iudge,

- 2 *This contrary motion here spoken of, is the iust conflux and conformity of such bodies to magneticall vnion.*

This is demonstrated by *Gilbert* in this manner. Let the whole magneticall body be *CD*, then *C* will turne to the North of the Earth *B*, and *D* vnto the South part *A*. Let this magnet bee cut in twaine by the middle line or *Aequator*, and the point *E* will tend to *A*, and the part *F*, will direct it selfe to



B: for as in the whole, so in the parts diuided, nature desires the vnion of these bodies. The end *E* willingly accords with *F*; but *E* will not willingly ioyne it selfe with *D*, nor *F* with *C*, for then it would haue *C*, against its nature, to moue toward *A* the South, or *D* in *B*, which is the South. Separate the stone in the place of diuision, and turne *C* to *D*, and they will conueniently agree and accord; For *D* will turne it selfe to the South as before, and *C* to the North; and *E* and *F* ioynt parts in the minerall or rocke, will now bee most sundred. For these magneticall parts concurre and meet together not by any affinity of matter, but receiue all their motion and inclination from the forme; so that the limits, whether ioynt or diuided, are directed magnetically to the Poles of the Earth, in the same manner, as in the diuided body.

- 3 If any part Southward of the magneticall body bee torne away or diminished, so much shall bee also diminished of the North-part; and contrariwise if any part bee taken away in the North-part, so much shall the vertue of the South part be diminished.

The reason is, because the Magnet hauing eminently in it the circles which are in the Earth, is separated or diuided by a middle line or *Equator*, from which middle space the vertues are conueyed toward either Pole, as we haue before shewed. Now any part being taken away from the North or South part, this *Equator* or middle line is remoued from his former place into the midst of the portion which is left, and so consequently both parts are lesse then before: For although these two ends seeme opposite, yet is one comforted and increased by the other.

- 9 Of the motions of Coition and Direction wee haue handled. It followes that we speake of the motions of the second order, to wit, *Variation, and Declination.*

- 10 Variation is the deuiation or turning aside of the directory Magneticall needle from the true point of North, or the true Meridian towards East or West.

In the discourse immediately going before, hauing treated of the magneticall body, wee haue imagined it to bee true, and pointing out the true North and South points of the Terrestriall Globe; which certainly would bee so, if the substance of the Earthly Globe were in all parts and places alike, equally partaking the Magneticall vertue, as some round Load-stone; neither should wee find any variation or deuiation at all from the true Meridian of the Earth: But because the Terrestriall Globe

is found by Nauigatours to bee vnequally mixed with many materialls, which differ from the magneticall substance, as furnished with rockie hills, or large valleyes, continents, & Islands, some places adorned with store of iron Mines, rocks of Loadstone, some altogether naked and destitute of these implements; it must needs fall out, that the magneticall needle and compasse directed and conformed by the Magneticall nature of the Earth, cannot alwayes set themselves vpon the true Meridian, that passeth right along to the *Poles* of the Terrestriall Globe; but is forced and diuerted toward some eminent and vigorous magneticall part; whereby the *Meridian* pointed out by the magnet, must needs varie and decline from the true *Meridian* of the Earth, certaine parts or degrees in the *Horizontall* circle; which diuersion wee call the *Variation* of the compasse: so that variation, so far as it is obserued by the compasse, is defined to bee an *Arch* of the *Horizon*, intercepted betwixt the common interfection with the true *Meridian*, and his *deniation*. This effect proceeding from the Inequality of magneticall vertue scattered in the Earth, some haue ascribed to certaine Rockes or mountaines of Loadstone, distant some degrees from the true Pole of the World; which rockes they haue termed the Pole of the Loadstone, as that whereunto the magnet should dispose and conforme it selfe: which conceite long agoe inuented, was afterward enlarged and trimmed ouer by *Fracastorius*. But this opinion is a meere coniecture, without ground: for what Nauigatours could hee euer produce that were eye-witnesses of this mysterie? or how can he induce any iudicious man to beleue that, which himselfe, nor any to his knowledge euer saw? The relation that the Frier of *Noruegia* makes of the Frier of *Oxfords* discovery, recorded by *Iames Cnoien* in the booke of his Trauels, where he speaks of these matters, is commonly reiected as fabulous and ridiculous; for had there bene any such matter, it is likely he would haue left some monuments of it in the records of his owne Vniuersity, rather then to haue communicated it to a friend as farre off as *Noruegia*. Moreover the disproportion in the degrees of *variation* in places of equall distance, will easily correct this error, as we shall shew in due places.

place. More vaine and friuolous are all the opinions of authors concerning this magneticall variation : as that of *Cortesi*, of a certaine motiue vertue or power without the Heauen ; that of *Marsilius Ficinus* of a starre in the Beare ; that of *Petrus Peregrinus*, of the Pole of the world ; that of *Cārdan*, of the rising of a starre in the taile of the Beare ; that of *Bestardus Gallus*, of the Pole of the *Zodiacke* ; that of *Linus Sannius*, of a certaine magneticall Meridian ; of *Francis Maurolycus*, of a magneticall Iland ; of *Scaliger*, of the heauen and mountaines ; of *Robert Norman*, of a respectiue point or place : All which Writers seeking the cause of this variation, haue found it no further off then their owne fancies. More probable by farre, and consonant to experience, shall wee finde their opinion, which would haue the cause of this variation be in the Inequality of the magneticall Eminencies scattered in the Earth. This Inequality may bee perceiued to bee twofold. 1. in that some parts of the Earth haue the magneticall minerals more then other parts ; for as much as the *Superficies* of some parts is solid Earth, as in great Continents : 2. Because although the whole Globe of the Earth is supposed to be magneticall, especially in the Internall and profound parts : yet the magneticall vertue belonging to those parts, is not alwayes so vigorous and eminent as in some other parts : as wee see one Load-stone to be stronger or weaker then another in vertue and power : but of those two, the former is more remarkable, which may bee shewed by experience of such as haue sailed along many seacoa-stes : for if a sea-iourney bee made from the shore of *Gusnea* by *Cape Verde* by the *Canarie* Ilands, the bounds of the Kingdome of *Morocco*, from thence by the confines of *Spain*, *France*, *England*, *Belgia*, *Germany*, *Denmarke*, *Noruegia* : we shall find toward the East, great and ample Continents ; but contrarywise in the West a huge & vast Ocean : which is a reason that the magneticall needle will vary from the true point of the *North*, and inclines rather to the *East* ; because it is more probable that these Continents and Lands should partake more of this magneticall minerall, then the parts couered with the Sea, in which these magneticall bodies may bee scarcer, or at the least deeper buried, and not so forceable.

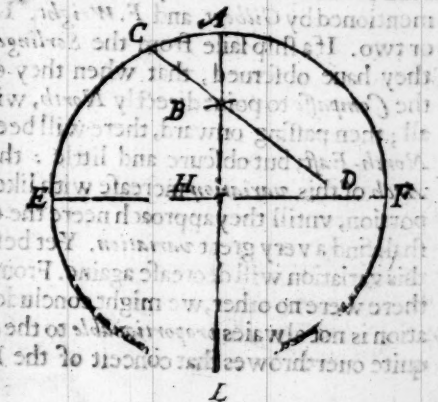
forceable. On the contrary part, if wee saile by the *American* coasts, we shall rather find the *variation* to be Westward: as for example, if a voyage be made from the confines of *Terra Florida*, by *Virginia*, *Norumbega*, and so Northward, because the land butteth on the West: but in the middle spaces, neere the *Canary* Islands, the *directory* needle respects the true Poles of the Terrestrial Globe, or at least shewes very little variation. Not for the agreement of the *Magneticall* Meridian of that place with the true by reason of the Rocke of Load-stone, as some haue imagined: because in the same *Meridian* passing by *Brasile*, it falls out farre otherwise: but rather because of the Terrestrial Continents on both sides, which almost diuide the *Magneticall* vigour, so that the *Magneticall* needle is not forced one way more then another; the manner whereof wee shall finde in *D. Gilbert* expressed in an apt figure, to whom for further satisfaction I referre the Reader.

1 *The Magneticall variation hath no certaine Poles in the Terrestrial Globe.*

It is but a common receiued error (as we haue mentioned) that there is a certaine Rocke or Pole of Load-stone; some degrees distant from the true Pole of the world, which the *Magneticall* needle in it's *variation* should respect. This Pole they haue imagined to be in the same *Meridian* with that which passeth by the *Azores*,

whence they haue laboured to shew the reason why the Compass should not vary in that place: which they explain by this Figure.

Let there be a circle describing the Spheare, *E* *F*, the Horizon *E* *F*, the Arctike Pole *A*, the Antartick *L*. The Pole or Rocke of Loadstone placed



placed out of the Pole of the Earth B. Let there bee placed a magneticall *directory* needle in H; it will (according to their assertion) tend to the point B, by the magneticall Meridian H B; which because it concures with the true Meridian B A, or H A, there will be no variation at all, but a true direction to the North Pole of the Earth. But let this magneticall needle be placed in the point D; it is certaine according to this opinion, that it will tend to the Pole of the Loadstone B, by the magneticall Meridian D B. Wherefore it will not point out the Pole of the Earth A, but rather the point C; because these two Meridians come not into one and the selfe-same. Hence they have laboured with more hope then successe, to find out the *longitude* of any part of the Earth, without any obseruation of the Heauens: which I confesse might easily be effected, if this coniecture might stand with true obseruation. But how farre this conceit swarues from the experience of Nauigatours, one or two instances will serue to demonstrate. For if the *variation* had any such certaine poles as they imagine, then would the *Arch of variation* bee increased or diminished proportionally according to the distance of the places. As for example; If in the compasse of an hundred miles, the Compasse were varied one degree, then in the next hundred miles it would vary another degree, which would make two degrees. But this hath often been proued otherwise by diuerse experiments of Nauigations, mentioned by Gilbert, and F. Wright. I will only produce one or two. If a ship saile from the *Sorlinges* to *New-found-land*, they haue obserued, that when they come so farre as to finde the Compasse to point directly *North*, without any variation at all; then passing onward, there will bee a *variation* toward the *North-East*, but obscure and little: then afterward will the *Arch* of this *variation* increase with like space in a greater proportion, vntill they approach neere the *Continent*, where they shall find a very great *variation*. Yet before they come ashore, this variation will decrease againe. From which one instance, if there were no other, we might conclude; That the *Arch* of variation is not alwaies *proportionable* to the distance: which granted, quite ouerthrowes that conceit of the Poles of variation. Be-

side this, if there were two such magneticall Poles, there can be but one common *Meridian*, passing by them and the Poles of the Earthly Globe. But by many observations collected and observed by *Ed. Wright* and others, there should be many magneticall *Meridians* passing by the Poles of the world: as in the *Meridian* about *Trinidad*, and *Barmudas*; the *Meridian* about the Westermost of the *Azores*: lastly, the *Meridian* running amongst the *East Indian* Islands, a little beyond *Jana Maior*, the magneticall and true *Meridian* must needs agree in one. Now for as much as all these magneticall *Meridians* passe by the Poles of the earth, there can no cause be assigned why the magneticall Poles should bee said to bee in one rather then another; and if in any, then in all. Whence it must needs follow, that as many magneticall *Meridians* as you haue to passe by the true Poles of the world; so many paire of magneticall Poles must you haue, which will be opposit to all reason and experience.

1 *The point of Variation, as of Direction, is only Respectiue, not Attractive.*

It was supposed by the Ancients, that the *Direction* and *Variation* of the Loadstone was caused by an *Attractive* point, which drew and enforced the lilly of the *Compass* that way: which errorr tooke place from another common-receiued opinion, that all the other motions of the magnet were reduced to the *Attractive* operation: but the errorr was corrected by one *Robert Norman*, an English-man, who found this point to bee *Respectiue*, and no way *Attractive*. Whose reason or demonstration is not disapproved by *Dr. Gilbert*, although in other matters hee sharply taxeth him. His experiment is thus. Let there be a round vessell, as we haue described, full of water; in the middle of this water-place an iron-wier, in a conuenient round corke, or boat, that it may swimme vpon the water, euen pozzed: let this iron-wire be first touched with the load-stone, that it may more strongly shew



the

the point of *variation*; let this point of variation be D, let this iron-wire rest vpon the water in the corke for a certaine time; It is certainly true that this iron-wire in the cork, will not moue it selfe to the margent or brinke of the vessell D, which certainly it would doe, if the point D were an attractive point.

3 *The variation of euery place is constant and not variable.*

This hath beene ratified by the experience of Nauigatours; which in the selfe-same Regions haue neuer missed the true variation which they haue assigned them before. If any difference bee assigned in variation to the same Region, wee may impute it to their error which obserued it, arising either from want of skill, or conuenient instruments. Neither can this euer be changed, except some great deluge or dissolution happen of a great part of land, as *Plato* records of his *Atlantick* Islands.

4 *The variation is greater in places neere the poles of the Earth.*

This proportion is not to be taken *uniuersally*, but *commonly* for the most part; yet would it haue truth in all places, if all other things were correspondent. It is obserued that the *variation* is greater on the coasts of *Norway*, and the *Low-countries* then at *Morocco*, or *Guinea*. For at *Guinea* the magneticall needle inclines to the East, a third part of one *Rumbe* of the *Compass*. In the Islands of *Cape-Verde*, halfe; in the coasts of *Morocco*, two third parts: In *England* at the mouth of *Thames*, according to the obseruation of *D. Gilbert*, and *Ed. Wright*, though some deny it, one whole *Rumbe*; in *London* the chiefe city of it, eleuen degrees and more, which we also find, or thereabout, in *Oxford*. The reason is, because the magneticall motiue vertue is stronger in the greater *latitude* increasing towards the pole: and the large Regions of land lying toward the Pole, preuaile more then those which are situate farther off.

12 Thus much for the Variation. The Declination is a magneticall motion, whereby the magneticall

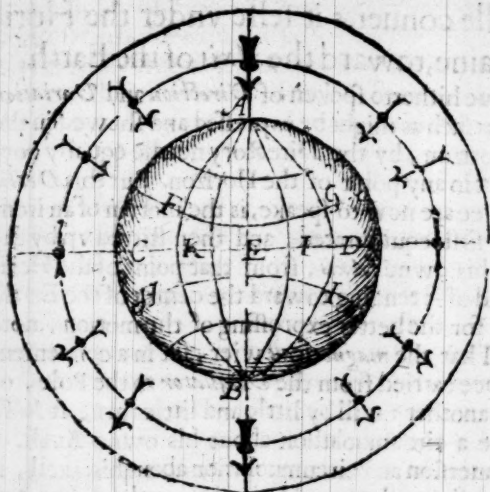
ticall needle conuerts it selfe vnder the Horizontall plaine, toward the *Ax*is of the Earth.

What wee haue hitherto spoken of *Direction* and *Variation* magneticall, was such as might be expressed and shewed in the plaine of the Horizon, by the Directory needle equally poyzed, when it is set in any point of the Horizon. But this *Declination* whereof wee are now to speake, is the motion of an iron-wire or needle, first equilibrated, and then stirred vp by the loadstone, vpon his owne *Ax*is, from that point of the Horizon, the other end of it tending toward the center of the Earth: where wee may, for the better expressing of the motion, note two things: 1 That the *magneticall* wiew, set in a conuenient instrument, if it bee carried from the *Aequator* to the Pole, or from one Pole to another: will by little and little turne it selfe round, and make a circumuolution about his owne Axell. 2 That by this conuersion and circumuolution about his axell, it will according to diuers places and latitudes, make diuers Angles in diuers places; both which are included in this motion of Declination, and are warranted by experience made by an *Inclinator* needle applyed to a *Terrella*, or round Loadstone; as also by the experience of *Nauigations* on the great Spheare of the Earth. To explaine which motion, there are curious instruments formed and inuented by *D^r Gilbert*, and *D^r Ridley*, which the curious in this kinde, to their greater satisfaction may peruse. In the meane time wee will here content our selues with one figure following, borrowed from their more copious inuention; wherein we shall find enough to expresse the manner of this motion. In this Figure let ABCD be the *Terrella* or round magnet representing the Spheare of the Earth: A the North-pole, B the South, AEB the Axell, CED the *Aequator*: AKB, and ALB the *Meridian* circles meeting in the Pole. AC, and BD the Meridian or right Horizon, hauing in it the two Poles: FG and HI two *parallels*. The Loadstone being thus designed in his outward Poles, as it is according to his naturall eminency stored inwardly: Let the Needles bee placed (being before touched) on the Limbe ouer-against the Poles,

E 2

AB,

270. 14. 11. 10. 9. 8. 7. 6. 5. 4. 3. 2. 1. 0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 229. 230. 231. 232. 233. 234. 235. 236. 237. 238. 239. 240. 241. 242. 243. 244. 245. 246. 247. 248. 249. 250. 251. 252. 253. 254. 255. 256. 257. 258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287. 288. 289. 290. 291. 292. 293. 294. 295. 296. 297. 298. 299. 300. 301. 302. 303. 304. 305. 306. 307. 308. 309. 310. 311. 312. 313. 314. 315. 316. 317. 318. 319. 320. 321. 322. 323. 324. 325. 326. 327. 328. 329. 330. 331. 332. 333. 334. 335. 336. 337. 338. 339. 340. 341. 342. 343. 344. 345. 346. 347. 348. 349. 350. 351. 352. 353. 354. 355. 356. 357. 358. 359. 360. 361. 362. 363. 364. 365. 366. 367. 368. 369. 370. 371. 372. 373. 374. 375. 376. 377. 378. 379. 380. 381. 382. 383. 384. 385. 386. 387. 388. 389. 390. 391. 392. 393. 394. 395. 396. 397. 398. 399. 400. 401. 402. 403. 404. 405. 406. 407. 408. 409. 410. 411. 412. 413. 414. 415. 416. 417. 418. 419. 420. 421. 422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839. 840. 841. 842. 843. 844. 845. 846. 847. 848. 849. 850. 851. 852. 853. 854. 855. 856. 857. 858. 859. 860. 861. 862. 863. 864. 865. 866. 867. 868. 869. 870. 871. 872. 873. 874. 875. 876. 877. 878. 879. 880. 881. 882. 883. 884. 885. 886. 887. 888. 889. 890. 891. 892. 893. 894. 895. 896. 897. 898. 899. 900. 901. 902. 903. 904. 905. 906. 907. 908. 909. 910. 911. 912. 913. 914. 915. 916. 917. 918. 919. 920. 921. 922. 923. 924. 925. 926. 927. 928. 929. 930. 931. 932. 933. 934. 935. 936. 937. 938. 939. 940. 941. 942. 943. 944. 945. 946. 947. 948. 949. 950. 951. 952. 953. 954. 955. 956. 957. 958. 959. 960. 961. 962. 963. 964. 965. 966. 967. 968. 969. 970. 971. 972. 973. 974. 975. 976. 977. 978. 979. 980. 981. 982. 983. 984. 985. 986. 987. 988. 989. 990. 991. 992. 993. 994. 995. 996. 997. 998. 999. 1000.



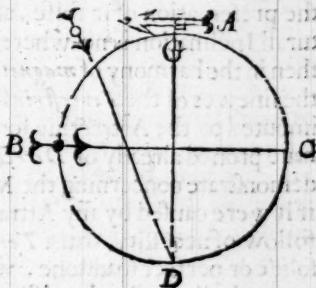
A B, and we shall obserue them to respect them directly, cōcurring in one straight line with the Axell of the Earth: Then set the same Needles in the Limbe ouer-against the Equator C D, and they will dis-

pose & settle themselves in a *parallel* site to the Axell of the Earth, and incline neither to one Pole or other: Hence may bee collected by plaine consequence, that there is a semi-circle betwixt each of these foure needles. Now to finde the *quadrants* of these, apply Needles in the Limbe at 33 degrees distant from the Equator on each side of him, and they will make right angles with the axell of the same, where these eight needles haue 8 quadrants between them, that is, foure semi-circles which will maketwo whole circles, one on each side of the Equator. But if you place the needles in the midst betweene the Equator and the Poles, they will respect the axell but *obliquely* as in all other parts, except in the eight places before-mentioned. From hence may we learne what we proposed: first that the *Declination* is a conuersion of the *magneticall* wire or needle vpon its owne axell: secondly, that this wire by this motion so excited, if it bee moued on any *Meridian* North or South, will apply and conforme it selfe according to certaine angles, to the Axell of the Earth. Thirdly, there will arise this corollary, that the magneticall needle about the round Magnet, maketh two circles. Concerning this

this declination wee will insert two especiall *Theoremes*.

I The Declination is unswerable to the latitude not in Equality of degrees, but in proportion.

It is manifest out of that which wee haue spoken, that this motion of *Declination* supposeth two motions; The one of *Conuerſion*, whereby the needle is turned round on his owne *Axis*: The other a *Progreſſiue* motion, whereby the center it ſelfe of the *Inclinatory* Needle is carryed forward vpon a Meridian from North to South, or contrarywiſe. Theſe two motions ſuppoſed to proceed and beginne together, cannot poſſibly meet in ſuch Equality, as that the degrees of *Declination* directly anſwer in Equality to the degrees of *latitude*, which is demonſtrated by this Figure here inſerted. Let the magneticall body bee A, this body while it ſhall bee moued about the Earth from G D the *Equinoctiall* toward the Pole B, will bee turned vpon his owne Center, and in the middle of the progreſſe of the center from the Equator to the Pole B, it will be directed to the Equator D in



the middle betweene the two Poles. Therefore the middle muſt needes turne faſter on his owne center, then the center it ſelfe turned forward; that by this conuerſion it ſhould directly reſpect the point D: wherefore this motion will bee ſwifter in the firſt degrees, to wit, from A to L, but in the latter it will be ſlower from L to B, in reſpect of the Equator from D to C. Now if the *Declination* were equall to the latitude, then the magneticall wiew ſhould obſerue and follow the facultie and peculiar vertue of the center of an *operative* and attractive point. But reaſon & experience teacheth, that it obſerueth the whole body and maſſe, with all the externall limits of the Earth and Load-ſtone; the whole vertues and forces of both concurring,

as well of the conuertible wiew, as of the whole Earth : Neuerthelesse from this experiment the skilfull in Magneticall Philosophie, haue found out a proportion whereby the latitude of places may instrumentally bee found out by the degrees of *Declination*.

2 *The Magneticall Declination is caused not of the Attractive, but of the Disponent and Conuersiue vertue of the Earth.*

There is nothing more admirable in Nature, then the order and situation of all bodies in their places, most conuenient for each ones conseruation. For the obtaining of which harmony, (as wee haue taught in our second Chapter) it is endowed with a proper *motion* conuenient, to place and seat it selfe, both for the preseruatiue of it selfe, and the whole Vniuersel. This naturall Inclination is no-where more eminent and conspicuous, then in the harmony of *magneticall* bodies, which are (as it were) the sinewes of the *Terrestriall* Globe. These motions some haue imputed to the Attractive force, but very erroneously, as wee haue proued already of *Direction* and *Variation*, and shall here demonstrate concerning the Magneticall *Declination*: for first, if it were caused by any Attractive force approaching it would follow of necessity, that a *Terrella* or round Spheare; made of a solide or perfect loadstone, would more turne and wrest the magneticall needle, then if it were made of a weaker and more imperfect substance: also that a needle touched with a stronger stone, should shew a greater Declination then that touched with a weaker. But experience hath found the contrary. Because the Declination will bee all one, bee the stone stronger or weaker. Moreouer a Loadstone armed with an Iron-Nose (as they term it) put vpon the Meridian in any latitude, will not lift vp a piece of iron more perpendicularly, then if it were naked and vncovered, although it will lift vp much greater and heavier waights; which experiments are sufficient to confirme our assertion, that this Declination is caused only by the disponent and conuersiue vertue of this *Terrestriall* Globe.

3 *The magneticall Declination hath a variation.*

That in the magneticall *Direction* there is found an Irregularity or variation, hath beene sufficiently warranted by Artificers Instruments. The like Irregularity is in the motion of Declination, which makes magneticall Instruments and experiments more subiect to error and imperfection. The *variation* of Declination is defined to bee an Arch of the Magneticall meridian betwixt the true and apparent Declination. The cause hercof is onely to bee sought in the vnequall temper of magneticall parts in the Earth. For as in the *Direction*, magneticall bodies are drawne and wrested from the true meridian, by the eminent and more vigorous force of the Earth, one side overruling the other: so the magneticall needle (the conuersion somewhat increased) declines sometimes beyond his naturall site and conformity. This may cause an error, but not of any great moment: sometimes when there is no variation or *Direction* at all in the Horizon, there may bee a Variation or Declination; to wit, either when the more eminent and stronger parts of the Earth are placed iust vnder the Meridian; or when these parts are more impotent then the generall nature requireth; or els when the Magneticall vigour is too much increased on one side, and diminished on the other as wee may behold in the vast Ocean.

C H A P. III.

Of the Totall motions Magneticall.

1 **H**Auing passed the Partiall motions magneticall, wee are next to speake of the Totall motions, which more neerly agree to the whole Earth, such as are the

Verticity and Reuolution.

2. The *Verticity* is that whereby the Poles of the earthly Spheare, conforme and settle themselves vnto the Poles of the Heauen.

1. The Spheare of the Earth by her Magneticall vigour, is most firmly seated on her Axell; whose Ends or Poles respect alwayes the same points in the Heauens, without Alteration.

That which in a little Magnet or Load-stone is called *Direction*, in the vast Globe of the Earth is called *Verticity*. To vnderstand which, wee must conceite, that the Earth hath naturally two Poles, vnto which the *meridionall* parts doe direct not only magneticall bodies neere the Earth, but her owne massie situation and firmenesse; and settles her selfe so strongly by her magneticall vertue passing through the Meridionall parts to the Poles, as if shee were tied by many strong cables to two *Herculean* pillars, not subiect to alteration: And if it should happen by any supernaturall power, that the situation could bee changed: shee would (no doubt) by her magneticall vigour and verticity, returne and restore her selfe to her former position, as all magneticall needles will doe to their proper site and conformity. Of this Verticity needes no more to bee spoken, then hath been already said in the point of *Direction*; because the former is a representation of the latter, and depends on the same demonstration. Out of which ground wee may evidently conclude, that the *Axell* of the Terrestriall Globe remaines alwayes inuariale: By which we may refute the opinion of *Dominicus Maria*, who was Master to *Copernicus*; who out of certaine vnperfect obseruations, was induced to beleue that the Poles of the World were changed from their true and naturall situation: I haue obserued (saith hee) looking on *Protonites* Geographic, that the eleuation of the Pole Articke almost in all Regions, as it is put downe in *Ptolomie*, differs and failes in one degree and ten minutes from that which wee finde in

in our time: which cannot bee ascribed to the error of the table, because it is not probable that the whole series should bee depraved according to this equality of number. Wherefore it must follow of necessity, that the North pole should bee mooved toward the verticall circle: which mystery not knowne of the Ancients for want of former obseruations, hath shewed it selfe to our times, being enriched not only with their, but our owne experiments. According to this opinion of *Dominicus Maria*, the North pole should bee eleuated higher then it was, and the Latitudes of Regions should bee greater then they were. But to this opinion we will oppose the opinion of *Stadius*, which holdeth that the latitudes of Regions haue beene decreased and diminished from that they haue had in *Ptolomie*, without any such regular Increment or Decrement; which hee labours to confirme by many obseruations: as for example, the latitude of *Rome* as it is set downe by *Ptolomie* is 41 degrees 3 parts: but by newer obseruation it is found to be 41 degrees 3 parts: out of which wee may well coniecture, that *Ptolomies* obseruations were not alwayes exactly true, being for a great part such as hee had receaued from *Hipparchus*, and not examined himselfe: as may bee scene in the latitude of many Cities in *Europe*, where hee missed sometimes 2, sometimes 3 degrees. Wherefore no iudicious Geographer would vpon such imperfect obseruations and vncertaine coniectures bring in a new motion of the earth to ouerthrow that magneticall Harmony and consistency corroborated with so many and sure demonstrations. This may serue to answer a certaine Tenent of *Vasquez* the Iesuite, and some others; who imagine the Center, and by consequence the Pole of the Earth, to bee mooved vp and downe by a certaine motion of Liberation. The argument on which they would ground their assertion, is taken from the Center of Gravity, in this manner. The whole masse of the earth (say they) is so settled about the Center, that it is equally poized: that is as much as to say, that the parts are indowed with an equall waight. Now such Bodies as are so equally poized by the addition or diminution of any part on either side, will bee straight-way turned from that side, which they

they had before in *Equilibrio*: as is dayly confirmed by experience of a Ballance, and other such mechanicke instruments. Wherefore in the Terrestriall spheare, the Center and Poles should in this wise bee changed and altered, and the whole suffer a kinde of starting or Libration. For it is manifest by dayly obseruation, that some things in the superficies of the earth are fallen off, and carried into another place: as Men, Beasts, and Birds, which moue from one place vnto another. Nothing is here of more moment then the motion of the Sea, by which the parts of the water by continuall ebbing and flowing, suffer such a sensible change of Addition and Diminution, that no man can imagine how the parts of the Earth about the Center should alwayes bee equally counterpoized, but the waighton on one side should bee predominant vnto the other, and so driue the Center from his former place. This Argument

*De Mundi
fabr. part. 3.
cap. 2.*

Blancanus, another late Iesuite, leanes altogether vnanswered; either imagining it too strong, or out of a combined faction of their owne society, vnwilling to contradict his fellow. And indeed should wee consider the spheare of the earth, no otherwise then according to his Elementary constitution: this reason would hardly admit of a solid answer: For howsoeuer in the vast frame of the Earth, the addition or subtraction of some parts would make but an insensible difference: yet can it not bee denied, but the least waight whatsoeuer added or subtracted, would turne it from its *Equall-poyze*: Neuerthelesse, this I hold too absurd for a Christian to beleue, for as much as it contradicts the sense of holy Scriptures, which ascribe the earth to bee so settled on her foundation, that shee should not at any time bee remoued, or shaken: which motion (as shall bee proued in the second Theoreme) I take to bee vnderstood of such a Trepidation of the Center and the Poles, which by a metaphor are termed the foundation of the earth, and not of the circular motion, as some haue laboured to wrest it. Wherefore nothing is here left vs to satisfie this doubt: but to haue recourse to his magnetickall verticity, whereby the poles of the Earth endowed with a magnetickall vigor, and ouerwaying the elementary ponderosity of the earthly parts, are (as it were)

Psal. 104.

so fast bound to respect the same points or poles in the Heavens, that the Center can no wayes bee shaken, or moued out of his place.

3 The Magneticall Reuolution is a motion by which the whole globe of the Earth is moued round.

Aristotle in his 1 booke *de celo* makes 3 kindes of simple motions, out of which hee labours to deduce the number of simple bodies. The first is the motion from the center, such as is of Fire and Ayre, and all light bodies: the second to the center, such as is of Earth and Water; the third is round about the center or middle, which hee ascribes to the Heavens: so that if this ground were true, the Earth could challenge to it selfe no other then the right motion; whereby the parts of it being separated from the whole, returne to it againe. But this opinion although popular and plausible, hath beene contradicted, as well by ancient Philosophers as moderne: for by long experience and diligent obseruation, they haue found the earth to bee endowed with a star-like vigour, whereby shee may, hauing all her parts vnited together by reason of her grauity vnto the Center, and her place made sure by her magneticall poles, moue naturally vpon her owne poles, at least if so bee shee claime no other motion. This opinion first blossomed (as farre as I can gather) in the Schoole of *Pythagoras*, was cherished by *Heraclides Ponticus*, and *Ecphantus*, two famous *Pythagoreans*: to which after ward ioyned themselves *Nicetus Syracusanus*, and *Aristarchus Samius*; all which haue vndertaken to defend that the Earth moues circularly, and that this circumsyration of the Earth causeth the rising and setting of the Sunne, as well as of other starres, although in the manner they haue not expressed themselves alike, hauing inioyed as yet scarce the first dawn of knowledge. But all this while Philosophie contented her selfe with the acquaintance of a few choice friends, not daring to prostitute her treasures to popularity. But when it hapned in after times that shee was taught the language of the vulgar, and spake to the vnderstanding of each mechanicke, shee doone contracted.

contracted some stains, and squared her selfe rather to please the most then the best. Thus the multitude as a vast torrent preuailed against the learned, and cast into exile the inuentions of the *Ancients*, which their ignorance was readier to censure then vnderstand. Yet were not the seeds of this Philosophy quite extinct, but as forgotten for a time; vntill there arose *Copernicus*, a man of incomparable wit, who quickned and reuiued it, to his euerlasting playse and our profit: I would not here be mistaken, as though I strongly apprehend these grounds, and reiect all the principles of our *Peripateticke* Philosophie: I only inueigh against their preiudicate ignorance, which ready to licke vp the dust vnder *Aristotles* feet with a supercilious looke, contemne all other learning, as though no flowers of science could grow in another garden. I confesse this opinion of the Earths circular motion to bee subiect to many and great exceptions, and opposed by strong and waighty arguments drawn probably from the booke of God, the touch-stone of sincere verity; yet I hold it too strongly fortified to be invaded by popular arguments drawn from seeming sense, and bolstered vp with names and authorities. For mine owne part, I confesse not absolute subscription to this opinion; yet could I not conueniently leane it out, because hauing vnderaken to insert this Magneticall Tract; I would not willingly mangle it in any part, but shew it whole and intire to the view of the iudicious; who herein may vse their Philosophicall liberty, to imbrace or reiect what they please. If these grounds seeme true, they will finde acceptance; wif otherwise, it cannot indamage Truth to know her aduersary. Wherefore I thinke no man will take it amisse that I insert this following *Theoreme*.

- 1 *It is probable that the terrestriall Globe hath a circular motion.*

Copernicus ascribes three motions to the spheare of the Earth, whereof the first is in the space of 24 houres about her owne axell; making the day and night, and is therefore called the *Diurnall*: The second is yereley, wherein the Center it selfe of the Earth is moued from West to East, describing the circle

of

of the Signes. The third is a motion of *Declination* performed in an annuall reuolution; reflecting against the motion of the Center; for the Axis of the Earth is supposed to haue a *conuertible* nature, whereas if it should remaine fixt, there would appeare no inequality of day and night, *Spring*, *Autumne*, *Summer*, or *Winter*: I will not here curiously distinguish the differences, limits, and periods of these three motions, but leaue it to the skilfull Astronomer, to whom properly it appertaines: it is enough for mee to shew it probable that the Earth should challenge to it selfe a circular motion, in prosecution of which I shall labour chiefly to establish that first motion which is of the Terrestriall globe about her owne axis, which is the easiest both to beleecue and vnderstand. That I may the better expresse the grounds of this opinion, I will labour to proue these two points. 1 That this opinion is consonant to reason. 2 That it no way contradicts the sense of the *Holy Scripture*. The former assertion wee will againe diuide into 3 articles. 1 That the motion which wee seeke to establish in the Earth cannot without much absurdity bee granted to the heauens. Secondly that it no way contradicts to nature of the *Earth* it selfe. Thirdly, that the arguments produced against this opinion, are not so strong, but may bee answered with probability. First therefore finding the dayly rising and setting of the Sunne, Moone, and other Starres to arise from some motion, wee are to seeke out the true subiect of this motion. It is agreed vpon by all that this subiect must bee the *Heauens*, which are carryed in 24 houres from East to West, or the *Earth* which must moue in the same time from West to East. For the first wee must take as granted of those which defend the opposite opinion these two grounds. 1 That the subiect of this motion (if it bee a heauenly body) is the first moueable and supream spheare of all the celestially machine; because all the rest haue assigned them their seuerall motions. 2 That of two bodies circularly mouing vpon the same Center, in the same space of time, that which is greater in quantity must needs haue the swifter motion; as wee see the spokes of a wheele to moue faster neere the circumference, but slower in those parts which are ioyned to the Center. This granted.

granted, wee shall find the greatest of the first and supremest orbes to bee so incomparably vast in proportion to the Earth, and the motion of it according to this magnitude to bee increased to such a swiftnesse, as must needs transcend all fiction and imagination. For besides the two Elements placed by the *Peripateticks* betwixt the *Earth* and the *Celestiall* bodies, to wit, *Aire* and *Fire*, which challenge no meane distance betwixt their concave and conuexe *superficies*: who knowes not how many distinct and strange concamerations of Orbes and circles are placed and signed out betwixt the *Moone* and the first Moueable? *Aristotle* hath reduced all the Orbes to eight, whereof seuen were allotted to the seuen Planets, but the eight to the sixt *Starres*, which hee supposed to bee fastned as so many nailes in the same wheele. But *Ptolomie* perceiuing this number to bee insufficient to satisfie his obseruations, was inforced to adde a ninth to encrease the number. Yet this contented not *Alphonsus*, but hee must make vp tenne. And although this opinion preuailed a longtime in the Schooles of *Philosophers*, as most exact and absolute; yet came it farre short to satisfie the searchof two latter Astronomers, *Clavius*, and *Maginus*; who to adde something to Antiquity, haue found out another orbe, and so the whole tale is become eleuen: and much it is to bee feared that the big-swolne belly of this learned *Ignorance*, will beget more children to help the Mother, because all the former haue proued lame and impotent: God send her a safe deliuary. To returne to my purpose; all these orbs thus ranged and concamerated in order, cannot but haue each of them a great and extraordinary thicknesse and profundity: being to carry in them such huge and vast bodyes, as the *Sunne* and *Starres*, which are of themselues mighty Globes, for the most part greater then the *Earth*, as *Philosophers* haue found out by diuers *Mathematicall* instruments, and expressed in *Tables*. Also because amongst the *Planetary* Orbes wee shall finde them clouen into many partiall and lesser Orbes, as *Epicycles* and *Excentrickes*, the first of which must in reason surpass the thicknesse of the *Diameter* of the Planet. The profundity of all these Orbes is measured by their *Diameters*, which wee shall find to surmount each

each other in extraordinary proportion. For the Diameter of the Earth is 1718 *German* miles. The greatest distance or elongation of the *Moone* being new, 65 semi-diameters of the Earth; the least is 55 semi-diameters. The greater elongation of the *Moone* in the middle space is 68; the least 52 semi-diameters of the Earth. Notwithstanding it is very probable, that the Orbe of the *Moone* is yet of more thicknesse and profundity. To passe ouer *Venus* and *Mercurie*, and come to the *Sunne*, wee shall find his distances from the Earth in his greatest *Excentricity* to bee 1142 semi-diameters of the Earth. *Mars*, *Jupiter*, and *Saturne*, are yet farther off from the Earth, and their Orbes endowed with a greater treasure of thicknesse. The distance of the *Firmament* wherein are placed the fixt *Starres*, is by the best Mathematicians thought incomprehensible, and not measurable by mans industrie: in so much that *Aristotle* holds the Earth no other then as a point, if it bee compared with the eighth Spheare, which hee supposed to bee the highest and first Moueable. To let passe the ninth Spheare; the tenth, which was vulgarly thought the first Moueable, if it bee valued according to the proportion of the rest, would haue his conuexe superficies moved so fast in one houre, that it would overcome so much space as 3000. greater circles of the *Terrestriall Globe*; for as much as in the conuexe superficies of the starry Firmament, it would containe more then 1800. And who can bee so sharpe sighted to see the profundity and thicknes of this orbe, containing in it *Starres* innumerable; whereof some are apparent to each mans eyes, others lying hid by reason of the distance, whereof many haue lately beene discovered, by reason of the Trunk-spectacle lately found out: so that it may bee a probable coniecture, that all these *starres* are not placed in the same Orbe, or at least that this Orbe is farre greater and deeper then the ordinary current of Astronomers haue imagined it to bee. To these eight Orbes here deciphered, should wee adde the *Calum Chrysellinum*, the *Primum Mobile*, the Idol of our common *Astrologers*; and another, which *Clauius* and *Maginus* haue inuented; what bound should wee set to the greatnes of the Heauens, or the swiftnesse of their motions? how farre beyond

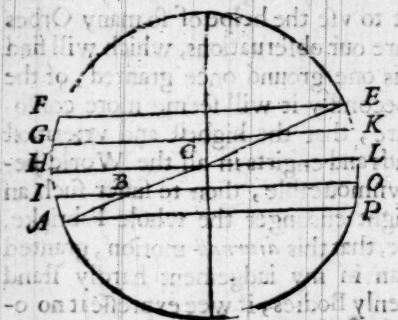
compare
page 83
with 80
and 89
Chap.

beyond all rousing imagination or Poeticall fictions should it transcend, as that which neither Nature could euer suffer, or the wit of man vnderstand? a motion a thousand-fold swifter then the flight of a bullet from a peece of ordinance, I had almost said, then thought it selfe: For if a man cast his imagination on some marke or degree in the *Sunnes* parallell on the Terrestriall Globe, and so instantly transerre it to another, and so to a third, passing ouer at each time the distance of 100 miles; hee would find the Sunne to bee farre swifter in his motion, and to haue ouer-passed him incomparably in his course: were the *Sunne* placed in the *superficies* of the *Earth*, and his course no greater then one of the greater circles of the Terrene Globe, hee should by their owne computation, finish his course in 24 houres; and so runne 21600 miles in that time, which maketh 900 miles in one houre. And if this motion seeme so swift, that it could hardly haue credit among ordinary capacities; what should wee thinke of this motion, which is imagined infinitely swifter? If *Ptolomie* feared lest the Globe of the Earth should be dissolved and shattered in pieces by a far slower motion; of what should wee imagine the heauens to be made, which can suffer so portentous and incogitable a whirling? Here the common Philosopher stands astonished, and rather then hee will be thought to know nothing, hee will say any thing: why (saith he) should wee not belecue it? sith the Heauens in their motion find no *Resistance*, whereas all other bodies are slackt by the *medium* or Aire by which they are to moue. If in the Heauens were any such let or hinderance, it would bee either in the *Agent* or Mouer; or in the *Patient* or body moued: Not in the mouer, because (as *Aristotle* hath taught) the Heauens are moued or turned round by an *Angell*, or *Intelligence*, fixed to his Orbe, of a *spirituall* and immateriall substance, which in a body meetes no opposition. Not in the body moued: because of it's owne Nature it is prone and inclinable to this motion. But this reason is like a reed that hurts his hand that leanes on it: for first, what *indigence* or necessity in Nature is obserued so great, to bee the father of such *Intelligences*? What serious indgment can euer imagine the *Angels* to bee like gally-slaves chained fast

to their gallies, or turne-spit-dogs labouring in their wheelles? To what vse shall they serue? not to *stirre* vp and beginne the motion; for why should we debarre the Heauens from the priuiledge of all other Bodies farre lesse excellent, whose motions challenge no other cause or beginning then their owne forme and nature: Not to *Regulate* and confine this motion; for Nature which beginnes any action or motion, is able of her selfe to set limits and bounds vnto it; without the helpe of any externall agent. Finally not to continue this motion; for as wee are taught in our *Philosophie*, Euery *Naturall Agent*, if it bee not hindered, still acts to the vttermost of his power, and therefore needes no externall coadiutor to continue his action: for otherwise we might suppose the Heauens to grow weary and faint in their intended course. Secondly, whereas they say there can bee no *Resistance* in the body moued, they contradict their owne grounds: for it is agreed by all, that the higher Orbs doe turne and wrest about the lower: I would willingly aske, by what kinde of action, either by a *vertuall* influence or emanation, or els by a *corporall* touch and application: The former is improbable, and (as farre as I can gather) not auouched by any; and were it so, it would seeme ridiculous; for why should wee rather ascribe this effect to an vnknowne influence of an externall body, then to the vigour of his owne *forme and nature*. For if one orbe in this sort can moue another, why could it not moue it selfe, being more present to it selfe then any other; If they say by a *corporall* application of bodies and their parts. I see not how they can anoid this *Resistencie* and reaction, which alwayes doth suppose some resistance: for how can one solide and hard body bee imagined to heaue and push another forward without some reluctancy in the patient? because the inferiour Orbe hauing of it selfe a proper motion, this must needes be violent, as supposing a forcing & wresting of Nature from her proper course, whereof it is not hard to shew a sensible demonstration; because the Orbe naturally directed one way, is turned and directed another way at the same time: which both motions concurring in the same body, must needes offer violence one to the other. Moreouer the im-

munity from corruptible qualities granted to the Heavens, which is the ground of this opinion; hath beene much talked of amongst the *Aristoteleans*, but neuer warranted by any certaine demonstration: wee see (say these Philosophers) the Heavens to haue remained since the beginning of the World, without any sensible alteration and change: and therefore must all the *Elementary* and corruptible qualities bee excluded. To disprove this, I need goe no farther then the last *Comet*, which Mathematicians by the *parallax* found to bee in the heavens. And whereas otherwise they seeke a sensible alteration in other parts, they deceive themselves: for as in the earth whereon wee dwell, howeuer the parts interchangeably corrupt and ingender dayly, yet the whole Globe will apparantly remaine the same, keeping it's integrity: so may it happen to many of the superiour Globes, whose parts dayly corrupted and renewed againe (although, for the great distance, to vs insensible) the whole Globe remaineth still perfect in his perfect *Sphericity*. I cease any further to inuade anothers Prouince, and therefore descend to a second argument, to proue this extraordinary, violent, and swift motion in the heavens to bee improbable. It is ordinarily obserued in other Orbes of the heavens, that the higher the Orbe is placed, the motion is slower; as for example, the Spheare of the Moone, which is next the Earth, is carried about in 27 dayes. *Mercury* and *Venus* are slow enough in their course, as the former in 80 dayes, the latter in 9 moneths: the *Sunne* in a yeere; *Mars* in 2 yeeres; *Iupiter* in 12; *Saturne* in 30. Also those Astronomers which giue the fixt starres a motion, would haue them to finish their course, according to *Ptolomie*, in 36000: but if wee will beleue *Copernicus*, in 25816 yeeres: so that the higher and greater the circles be, so much slower will be the motion: what iniury were it then to the concord and harmony of Nature, to impose vpon the highest Orbe of all, such an unmeasurable strange motion, which might strike the most *Seraphicke* Angell into admiration? To these may bee added other Arguments in *Copernicus*, which albeit they be not demonstratiue, will make the matter more probable. First, that Nature in all things is a compendious and short worker, and vseth not
many

many helpes for such things as may bee performed by fewer : and therefore need wee not to vse the helpe of so many Orbes and concamerations to square our obseruations, which will find more steady footing in this one ground once granted, of the Earth's *circular* motion : Secondly it will seeme more consonant and agreeable to Nature, that the highest and vtermost Spheare of all, which bounds and engirts in all the World besides, should rest quiet and vnmoueable, then to suffer such an intollerable motion, as might endanger the whole Fabricke. Lastly, I may adde this one, that this *diurnall* motion, granted to the first Moueable, can in my iudgement hardly stand with the regularity of heavenly Bodies, if wee expresse it no otherwise then the ordinary sort of Astronomers. For a regular motion is defined, to bee that whereby in equall times a body is moued through equall places. But this *Diurnall* motion receiued from the first Moueable, concurring with the *Sunnes* annual motion, will exclude this equality. For first it is granted, that the Sunne in his motion from the *Aequator*, to the *Tropicke*, according to sense, runnes euery day in a distinct *parallell* : for although euery minute hee declines somewhat from the *Aequator* toward the *Tropicke*, yet the difference is not sensible : so that wee may well euery day assigne a *parallell* line to the *Sun's* motion. Secondly, they must grant that these *parallells* are diminished, and grow lesse and lesse toward the *Tropicke*, from the *Aequator*. Thirdly, that (as wee haue fore-shewed) of two bodies mouing in the same time on the same center, that should moue faster, which is greater : so one body mouing in diuerse vnequall circles, in equall time, it must of necessity follow that it must needs moue faster, in that which is greater : here wee may conclude, he moues faster in the *Aequator*, then in the *Tropicke*, because in the one hee is carryed in a greater *parallell*, in the other a lesse, and yet in the same period of time, as wee may see in this Figure following. Let the *Sunne* bee in the point of the *Eclipticke* A, it is manifest that he will sensibly moue for that day in the *parallell* AP. Then let him bee moued by his periodicke motion, into the point of the *Eclipticke* B, it will for that moment moue in the



parallel I B O. Last of all, let it bee in the point of the Equator C. his parallel will bee HCL. It is manifest out of our former grounds, that he will be moued slowest in A P. Faster in I O. Fastest of all in H C L. Which swiftnesse and slownesse in the Suns motion makes it irregular. Some haue thought to salve this by saying that this motion is *Regular*, because in equall time, the Sunne goes *proportionall*, not *equall* spaces, which *Aguillonius* holds in his *Opticks*. But this shift is friuolous; because it takes not away the objection, why the Sunne should moue faster and slower. For the Heauens being a *naturall*, not a *voluntary* agent; and according to these grounds finding no hinderance or impediment; must alwayes worke to his vtmost power, and so cannot slacke or increafe his action, or motion; that it should moue faster or slower. Hitherto haue wee shewed that this *Diurnall* motion cannot without some absurdity bee granted to the heauens: in the next place we are to shew, that it no way can crosse the *Naturall* disposition of the *Earth* it selfe; which wee shall demonstrate in this manner. If this circular motion should crosse the disposition of the Earthly Globe, it would happen either immediatly in respect of the meere Nature, which the *Logicians* call *a-priori*, or els in regard of certaine properties, which follow necessarily the Nature of it, which they terme *a-posteriori*. If they say it happens *a-priori* in regard of the meere Nature; they must necessarily haue recourse to the *properties* and accidents for a demonstration: For the Internall formes of all things being in themselves insensible, cannot be discovered *in-to* vs but by their externall properties: But if probable coniecture may here find any place, I see no reason why the earth being found to bee of a magneticall temper, should not challenge the

the same which other magneticall Globes farre greater then the *Earth*, possesse; to wit, a circular reuolution about her owne Poles; which *Kepler* and *Galilei* haue obserued, aswell in the *Sunne*, as *Iupiter*; and in like matters to iudge alike, seemes more warrantable, then to faigne a disparity, which Nature neuer grounded, or obseruation found. But this, as a matter of small note, I easily passe ouer, following the foot-steps of our Aduersaries, which seeke to demonstrate the *Earth's stability* out of the externall effects and proprieties. If then this *Reuolution* contradict any propriety, it must bee of necessity either in regard of the *Quantity* and *Magnitude*; or els in respect of the *figure* and *quality*, or of some *Motion*, or of the *site* and *position*; for I find no other propriety of any moment which can enter into this consideration: First, that the *Quantity* can no way thwart this circular Reuolution, is manifest, because it would happen either in that it were too *Great*, or too *Little*. It cannot be by reason of the greatnes; because the great globes of the *Sunne* and *Iupiter*, manifold greater then the Globe of the *Earth*; are by late experiments of the Trunk-spectacle, found to moue about their owne Axell in a small portion of time: the like haue others delinied of the *Mars* and *Venus*. It is not then the *Mass* or quantity which can hinder it in the *Earth*; neither on the other side can it bee the *smallnesse*: for bodies smaller are found as apt, or rather apter to receiue a circular motion, which they will not deny mee; and therefore cannot this be preiudiciall to the motion of the *Earth*. In the next place, the figure of the *Earthly* Globe cannot hinder this motion, because by all found Philosophers, being acknowledged to bee *Sphericall*, it cannot but bee deemed most apt to receiue *Reuolution*; in so much as some haue hence laboured to draw an argument for the *Earth's* circular motion, as deeming this Figure to be giuen to the *Earth* for no other end or vse. Thirdly, no *Quality* in the *Earth* can resist this circular motion; for this quality (by the consent of all) would bee the naturall heauines or waight of the *Earth*: But this heauines takes not away the naturall *Reuolution*: 1. Because *Gravity* or heauinesse is nothing els but the inclination of the parts of the *Earth*, returning to their na-

tural place, hauing beene sequestred from it: but these parts hauing once regained their proper places, moue no farther, nor are in those places esteemed heauy, or waighty: whence it is commonly said amongst the *Peripatetickes*, *Nihil grauitat in suo loco*, nothing is heauy in his owne place, which may easily bee demonstrated out of *Staticke* principles, whereby we finde heatinesse and lightnesse to bee giuen to the bodies according to the *medium*; and their massinesse and solidity in respect of one to the other. 2 If this heatinesse bee opposed to the circular motion then either *immediatly* by it selfe, or *secondarily* by some concomitant accident. It cannot bee the first, because grauity is a quality; but motion; an action; which for ought my Philosophy hath taught mee, are not opposite: If by reason of some accident; then (no question) because it is contrary to lightnesse or leuity, which seemes requisite to such a motion: We willingly yeeld this naturall grauity of the parts of the Earth to stand opposite to the motion of *Ascent* or mouing vpward from the Center; but neuerthelesse it is not any way contrary to the circular motion: 1 Because contraries are alwayes supposed to be *in eodem genere*, in the same kind: but the motion of heauy bodies to the Center, and of the Earth about the Center, are not in the same kinde, the one being a *right* motion, the other *circular*; neither can the waight of the Terrestriall masse adde or diminish any thing in regard of the circular motion, because a *Sphericall* and a *right* motion cannot either directly concurre, or directly oppose one the other. 2 Wee may vrge out of the 4 Chap. of *Aristotles* 1 booke *De Celo*, That no circular motion can admit of contrariety: which hee confirms by a demonstration, which wee forbear here to insert, being loath to roae too farre from our present matter. At length wee will proue that this orbicular motion giuen vnto the Earth, cannot ouerthrow or thwart any other motion of the Earth: for if this were so, it would happen for one of these two respects; Either because the Earth hath some motion or other contrary to this; or els because diuers motions cannot bee in the Earth. The first cannot be true, for that wee haue spoken before; because the right motion they finde in the Earth, cannot bee iudged contrary to the *Sphericall*,

Spherical; neither can the later bee admitted as an vndoubted truth; for howsoeuer *Aristotle* sets it downe for an Axiome, that *one simple body hath but one simple motion*, yet being absolutely vnderstood without any limitation, will bee found by experience false: for it is manifest out of the experiment of the new *Periscopes*, that the Bodies of the *Sunne* and *Iupiter*, simple in nature, (if wee beleue *Aristotelians*) haue at least a double motion, the one vpon their owne Poles lesse then *Diurnall*, the other of their *Centers*, which are moued from the West vnto the East, vpon other Poles familiarly knowne vnto Astronomers. The *Peripateticke*s heere seeke an euasion, by distinguishing the motions of the Planets into a proper or naturall, and *Accidentall* or mutuaticious: but this answer comes nothome to this present question. First, because these two motions of the *Sunne* and *Iupiter* will easily bee proued to bee *naturall* and without violence, or restraint: Secondly, because in this answer they suppose the Heauens to bee cut and diuided into diuerse *Orbes*, *Sections*, and *Concumerations*, which later Astronomers vpon better experience haue derided, or at least omitted as *Hypotheses* or suppositions, to settle Imagination, rather then *reall*, or true grounds. If they would vnderstand this Principle of *Aristotle*, to wit; *That one simple body should challenge one simple motion*: of a motion of the same kinde it might perhaps obtaine some credit. But the right motion of the parts ioyning to the whole, and the Circular motion: also the Circular motion of a Planet about his owne Axell, and the Circular motion it selfe about the Earth, are found to bee diuerse kindes, and therefore no way incompatible in the same subiect. Morcouer what infallible argument can perswade vs, that the Globe of the Earth is a meere simple Body, such as *Aristotle* describes vnto vs in his Philosophie? Either this imaginary simplicitie must bee sought in the *Reall Existence* of the Earth, or els in our *mentall Abstraction*. The former they cannot auerre, because not only the Elements themselves, by their owne confession, are impure and corrupted: But the whole Globe of the Earth seemes to consist of diuerse mixtures, and Heterogeneall bodies, which apparantly exclude such simplicity. If they

- July 5th 1727
John Harrison

they would haue it rather to consist in the Abstraction or separation of the minde, which may diuide and distinguish between the true nature of the Earth, and his Accidentall Natures; I shall not contradict: although it seeme rather grounded on imaginary conjecture, then experience: That the Earth off it selfe distinguished from the waters, should haue any such simple Nature. If wee follow reason and experience as our Guides, wee shall obserue in the Terrestrial Globe a twofold constitution; The one *Elementary* from the parts whereof it consists, out of which it cannot challenge any motion, but the *right*, which is of the parts separated from the whole, agreeing to the Earth, Water, and all other heavy bodies thereof consisting. The other magneticall, wherein all other bodies are vnited in one *Magneticall* forme of the Earth. In which sort the whole Globe of the Earth may bee termed a *Homogeneall* substance; for howsoeuer the matter and the Elements whereof it consists, seems *Heterogeneall*, and diuerse one from the other; yet since in this Magneticall Nature, there is a Harmony and Communion, well wee may call it a Homogeneity of the Forme and Nature; not of the *Matter* and *Quantity*, as common Philosophers commonly vse the word: So that euery part or Element whereof this Terrestrial Spheare is compounded, may claime his owne motion, and properly; yet all conspiring in one vniuersall forme of a Sphericall Body, may notwithstanding be turned round with a Sphericall motion. In the last place wee are to prone that this Circular motion granted vnto the Earth, can no way oppose or indanger the naturall *size* or position of the Earth: If the situation or position were feared to bee changed, it must needes happen one of these waies; either that the *Center* of the Earth should bee moued out of his place: or that the *parts* should bee separated & distracted one from the other; or that the *Poles* should be changed and altered: The first cannot touch our assertion; because in this place wee affirme not, that the center of the Globe is moued out of his place; but that the whole Earth in the same place is turned round vpon her owne Center. For the opinion of *Copernicus*, which holdes the Center of the Earth to moue round about the earth, wee shall

censure

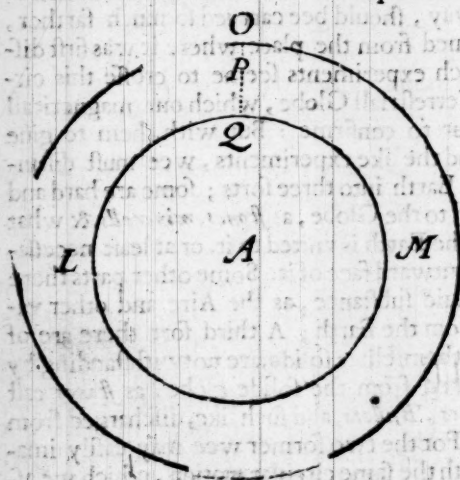
censure in our next Chapter. In the second place, the parts of
 the Earth by this motion cannot bee separated or disunited one
 from the other: first, because all the parts are united to the
 whole by their naturall gravity; that if by chance they should
 bee separated, they would naturally returne backe vnto their
 owne place. Secondly, this motion is supposed *Naturall* & not
violent, which in so great and massie a Body, can make no sen-
 sible Alteration. Lastly, the Poles of the Earth by this meanes,
 cannot bee moued out of their places; because by a certaine
Magneticall verticity (as wee haue formerly shewed) the
 same Poles of the Earth alwayes naturally respect the same
 points of the Heauens, as if they were bound vnto two firme
 Pillars indissoluble. Hitherto hauing proued the *Circular* mo-
 tion of the Earth; neither to bee giuen to the Heauens without
 some absurdity, and yet no way to contradict or oppose the
 Nature of the Terrestriall Globe; wee are in the third place to
 examine the reasons vsually vrged against this Assertion. The
 first reason is drawne from *sense*. If there were any such *Spheri-
 call* motion (say they) how comes it to passe, that it cannot of
 vs bee perceiued? an Argument worthy such Philosophers;
 as measure all rather by seeming sense, then *Demonstrating*
 reason; who cannot obserue on the sea in a calme, that the ship
 wherein hee is carried will seeme to rest, or at least to moue
 slowly, and the cliffs and shores to moue vnto the opposite
 part? What then should wee thinke of the motion of the whole
 Terrestriall Globe? which hath lesse cause to bee percei-
 ued, then that of a ship? The Bulke of a ship in respect
 of the Earth is small and of no quantity; the other being huge
 and massie: The motion of the ship meereley violent, inforced
 by the windes; of the Earth naturall and vniforme, stirred vp of
 his proper and naturall inclination, so that if any such motion be
 in the earth, it were impossible to bee perceiued by sense: Se-
 condly, they vrge against vs, that in *Homogeneall* Bodies, there is
 the same motion of the *whole*, and all the *parts*: But euery
 part of the Earth (as experience teacheth) is moued downe-
 ward toward the Center; and therefore the whole can haue no
 other motion: To this obiection wee haue partly answered be-
 fore;

fore; yet to giue further satisfaction, wee will adde something more: It is one thing to speake of the *whole* Terrestriall Globe and Spheare; another of the seuerall *parts* and Elements whereof it consists: If the whole Spheare bee vnderstood, wee ascribe vnto it no other motion but the circular, which wee here labor to establish. The parts, whereof this Terrestriall Spheare consists, may bee considered two wayes; either as they are *vnited* in the whole by a Magneticall forme, or *disioyned* and taken by themselves: In the former the parts of the Earth are supposed to moue in the same motion, by which the whole Spheare of the Earth is moued; because the *whole* and all the *parts* taken together, are the same, and subiect to the same circular reuolution. Notwithstanding this, any *part* seuerall and disioyned from the whole, hath a right motion downward toward the Center, by which it returnes to its true naturall vnion. This inclination of the parts agrees not with the whole Earth, neither vnto any part vnited and conglobated to the whole; but onely to a part separated from his place; so that the whole, may notwithstanding in his place inioy a circular motion. Now to come more neerely home vnto their Arguments drawne from the *Homogeneity* of the Earth, wee answer as before, that there is a twofold *Homogeneity*: The one of the *matter* and quantity; the other of the *Magneticall forme* and Nature of the former: wee may conclude out of the right motion of all the parts, the disposition of the whole, so wee vnderstand it in a good sense: first that euery part is here to bee vnderstood, not in, but out of his proper place: Secondly, that by the *whole*, wee ought not to vnderstand the whole Globe with all his parts, conformed in one Sphericall frame; but all the parts *indefinitely* taken; for if wee should vnderstand of the whole Globe, their Argument will in no way hold true: If according to the later, wee might well grant them their Conclusion, yet can it not oppugne our Assertion: Because it will follow out of the Naturall inclination of euery part, that all the parts seuerally taken, haue such a disposition of returning to the Earth, being separated there from: Yet will not this by any necessary inference bee proued to agree to the whole Globe of the Earth; but rather will it follow

follow contrarywise, that the whole Spheare of the Earth is moued circularly, and therefore euery part with, and in it, is moued with the whole in the same motion. A third argument which is thought greater then all the other, is drawne from two experiments: The first is, that a *stone* or *Bullet* let fall from a higher place to the ground, will perpendicularly descend to the point of the Earth right vnder: Secondly, that two *Bullets* imagined to bee of equall weight and matter, being discharged from equall pieces of ordinance, with the like quantity of powder, the one towards the East, the other towards the West, will reach an equall distance in the Earth; both which would seeme impossible if wee grant this supposition of the Earths circular reuolution. For in the former case, the Earth sliding away swiftly during the fall of the stone, would change the point marked out for another: And in the second, for the like cause, the Bullet shot towards the East, being preneted by the swiftnesse of the Earth's motion, carrying along with it the Ordinance out of which it proceeded, should retorne baek over the shooters-head; and contrarywise that Bullet shot towards the West, besides his owne motion, by the motion of the Earth the other way, should bee carryed so much farther, as the Earth is remoued from the place where it was first discharged: Both which experiments seeme to crosse this circumgyration of the Terrestrial Globe, which our magnetical Cosmographers labour to confirme: But with them to giue an answer to these and the like experiments, wee must distinguish the parts of the Earth into three sorts; some are hard and solide parts, adioyned to the Globe, as *stones*, *minerals*, & what else in the bowels of the Earth is vnited to it, or at least necessarily adherent to the outward face of it. Some other parts there are of a thinne and fluid substance, as the Aire and other vapours in it, deriued from the Earth; A third sort there are of such parts as being in themselves solide, are notwithstanding by some violence separated from the solide globe, as *stones* cast into the Aire; *Arrowes*, *Bullets*, and such like, discharged from the hand or Engine: For the two former wee may easily imagine them carried with the same circular motion, which we as-

signe

signe vnto the *whole*, being no other then the parts of it depending from the whole masse: For the third sort (whereof consists the difficulty) wee cannot imagine them so moued round, as if they were wholly separated from the Communion of the Earthly Spheare; for howsoeuer there seemes a separation according to *matter* and quantity, yet retaine they the same magneticall inclination to the whole masse, as if they were vnited to it; and therefore such solide parts are moued with the same vniforme and naturall motion wherewith the Earth it selfe is turned; so that in solide bodyes so separated from the superficies of the Earth, of an Arrow or Bullets shot, wee must imagine a twofold motion: The one *Naturall* & vniforme, whereby they are moued as homogeneall parts according to the reuolution of the whole Spheare: The other *violent* by force impressed from the Agent: The right motion proceeding from the strength of the shooter, cannot crosse or hinder the *Naturall*, because the one being right, and the other circular, admit no such proportion, as that one should hinder or further the other: Neither can these motions well be tearmed contrary or opposite, which are in diuers kinde: To explaine this matter farther, we



will adde this Diagramme; Let the whole orbe of the earth bee imagined to bee *L Q M*; whose center is *A*, the thickness of the Aire ascending from the Earth *O Q*. Now as the orbe of this fluid substance of the aire ascending vniformely is moued round with the Globe

Globe of the earth, so must wee imagine the part of it marked out by the right line OQ to bee carried round with an vnalterable Revolution. Wherefore if any heavy body should bee placed in the Line OQ ; as for example P , it will fall downe toward the center by the shortest way in the same line OQ ; which motion downewards towards the center, can neither bee hindered by the circular motion of the Earth, nor yet *Mixt* or compounded with it: It cannot bee hindered: because (as wee haue shewed) a Right motion and a circular being not in the same kind, cannot properly bee reputed contrary: Neither for the same cause can they bee mixt or compounded: Wherefore this motion will be no other then one simple and Right motion, neuer varying from the Line OQ : which being once vnderstood, it is no hard thing to imagine a Bullet or stone forced by equall strength from Q towards L , and from Q towards the point M , to obserue alwayes a like distance notwithstanding the Earth's circular Revolution. Having hitherto shewed this Spherical motion of the Earth to bee possible, and no way to contradict Nature, wee are in the next place to shew it to bee no way opposite to the sense of holy Scripture. This opinion of the Earth's circular motion, hath suffered much wrong by a certaine perswasion of some men, that it contradicts the Text of *Holy Scripture*. Some precise men, more ready to vrge, then vnderstand what they alleage, will condemne without examination, and sticke to the plaine letter, notwithstanding all absurdities, denying the conclusion in despite of the premisses. To these haue associated themselves another sort, more to bee regarded, as more learned; the *Criticks* (I meane) of our Age, who like *Popes* or *Dictatours*, haue taken vpon them an vniuersall authority to censure all which they neuer vnderstood. Had these men contained themselves in their own bounds, they might questionlesse haue done good seruice to the Commonwealth of Learning. But when the seruant presumes to controule the Mistris, the house seemes much out of order. To seeke for a determination of a *Cosmographicall* doubt in the Grammaticall resolution of two or three *Hebrew* wordes, (which some haue gone about) were to neglect the kernell, and make

make a banquet on the shells. But howsoever, we hope to make it appeare, that the Scripture vnderstood as it ought to bee, is to farre from fauouring their opinion, that the words themselves can hardly admit of such a sense, as they would fasten on them. But ere wee descend to the examination of particular places of holy Scriptures alleaged in their behalfe, wee will shew this opinion to bee much different from that of *Copernicus*, as somewhat more moderate, and able to suffer an easier reconciliation with the holy Text. For the places alleaged of sacred Scripture, which seeme to oppose our Assertion, either seeme to proue the *circular* motion of the Heauens, or the *rest*, and stability of the Earth. But this opinion holding a Mediocrity betwixt both, neither takes away the motion from the *Heauens*, neither oppugnes such a Rest or quietnesse in the *Earth*, as the Scriptures vnderstand. For first, albeit wee take away from the Heauens the *diurnall* motion, and giue it to the Earth: yet we grant to the heavenly Orbes their *seuerall* motions, allowing no part of it to bee absolutely voide of motion. Secondly, wee must vnderstand this in a fourefold sense; as opposed to foure kindes of Motions. First to the *progressiue* Motion of the *Center* of the *Terrestriall* globe from place to place, Secondly, to the *separation* or dissolution of the parts one from the other, by which the Globe may loose his integrity. Thirdly to the *Translocation* of the Poles, whereby the Poles inclining to one side or another, may bee imagined to change their position. Fourthly, to the *Diurnall* Motion. In the first sense wee giue a Rest and stability to the Earth, because the Earth, howsoever moueable, wee place in the Center of the world, as wee shall proue in the next Chapter. In the second sense we also grant it; because all the parts of the Earth being of a heavy nature, fall naturally downewards, and vniue themselves vnto the whole, to decline such a dissolution: In the third acception wee likewise allow such a stability: because the Poles of the Earth (as wee haue shewed) by their magneticall inclination, alwayes respect the same points in the heauens, and can from thence by no meanes remooue themselves. Only in the fourth and last sense wee exclude a Rest, allowing onely a diurnall Revolution from West to East in twenty foure houres. The
first

first argument alleaged against vs is taken out of the 1 Chapter of Ecclesiastes: *Vna generatio* (saith Salomon) *abit, & altera aduenit; quoniam Terra in seculum permaneat.* Wherein by the word עֲמֻמָּה which some interpret (*Stas*) they would inferre a perpetuall stability of the Earth. A childish consequence, which a graue Diuine might well bee ashamed to urge: every man of common vnderstanding may plainly perceiue that *Salomon's* scope in this Chapter was, to shew the vanity & vncertainty of all things vnder the Sunne: which as a speciall argument amongst others hee amplifies from the successiue mutation and changes of men living on the Earth: in that one generation goeth away, and another cometh, but the Earth keeps her integrity, and remains in the same state. This Constancy then, or remaining of the earth, we can in no wise oppose to any circular motion, but to the changes and vncertainty of men in their generations; in which sense our most learned Linguists vnderstand it. Would not this seeme to any man a ridiculous argumentation, if any man should thus dispute: One Miller comes, and another goes, but the Mill remains still: *Ergo* the Mill hath in it no motion? Or in a Riuer, one generation of Fishes is produced, and another is decayed; but the Riuer remains the same, *Ergo* the Riuer remains still vnmoued? Let any man goe no farther then the plaine wordes whereon these Grammarians stand, hee will easily find out another interpretation. For the word עֲמֻמָּה deriued from עָמַר signifies as much as to persist, subsist, or to endure, being opposit to בָּעַר which signifies as much as to stagger or start aside from his place, or position: so that nothing from hence can bee inferred to contradict the Sphericall Revolution of the Earth in her proper place, vpon her owne Poles, which we only maintaine. A second reason they draw from the Psalm 104, out of these *Fundamēt* words, *עַל-צִבְיֹוֹת בְּלִמְסֹוֹת עֹשֶׂה וְעָרָא* *Terram su-* wherein, (as one would perswade) no lesse then three argu- *per bases su-* ments are couched in three bare termes: But these arguments *as, ne dimo-* will (I feare) proue as little as the former. For first the word *neatur in* *צִבְיֹוֹת* signifying as much naturally as to found or seat in a place *seculum.* or frame, is not altogether, without a Metapher giuen to the vers. 5.
Earth;

Earth, because Almighty God hath so placed it vpon her owne center Poles and Axell, that shee cannot bee moued out of it: Likewise *מרכיז* implies no other then a seat or place, being deriued from the word *כרר* which signifies no more then to perfect, establish, or make ready: The third is *תמריט* from the word *מריט* which can signifie no other then to incline, to nod, slide, fall, or turne aside out of his place: All which can suffer no other paraphrase or Interpretation then this, That Almighty God hath set the Globe of the Earth so strongly fixed in her proper frame, that no power can bee so strong to dissolue this Fabrick, or turne her out of her appointed place: which exposition of this place of Scripture, *Copernicus* himselfe would easily grant, as no way opposite to the triple motion hee labours to establish. Here are these three arguments drawne from three words, suddenly shrunk into nothing. Another reason which I take to bee stronger then the former, some haue taken out of the 19 Psalme; where speaking of the *Sunne*, hee vses these words. *In them hath hee set a Tabernacle for the Sunne, & which is as a bridegroom comming out of his chamber, and reioyceth as a giant to runne his course: 6 His going forth is from the end of the Heauens; and his circuite vnto the ends of it: and there is nothing hid from the heat thereof.* Out of which words the Heauens should seeme to challenge the motion, which wee haue giuen vnto the Earth. To this we answer two wayes: First, that although this may oppugne *Copernicus* his opinion, that the *Sunne* standeth still in the midst as the center of the World; yet may it well stand with our Assertion, who allow the *Sunne* his seuerall motion in the *Eclipticke*: whether those words of the Psalme bee to bee vnderstood of the *Sunnes Diurnall* or *Periodicke* Motion, is not so soone decided: the Scripture not specifying expressly either. 2 we may answer with the *Copernicans*; That the Holy Ghost in these or the like places speaks *Ανδεμαυδως*: being willing to descend to the weakest of mens capacity, and not to trouble mens conceits with such matters as to vulgar iudgements might seeme vnlkely or improbable. The like Analogie of speech may wee finde in the first of *Genesis*, where the *Moone* is called one of the greater lights

lights in regard of her appearance, being notwithstanding one of the least. These may suffice to shew the opinion of the earths circular motion to bee probable: I promised no more, & I hope I have performed no lesse. I neuer held it an article of my faith, to defend the one, or oppugne the other; and therefore leane euery man to his owne free iudgement, to embrace or reiect what he please.

*Copernicus
Systeme*

CHAP. V.

*Of the Site, Stability, and Proportion
of the Earth.*

OF Terrestriall affections which agree in respect of the Earth it selfe, wee haue hitherto spoken: We are now to treat of such as agree to it in respect of the Heauens. These are chiefly three; 1 The Site, 2 The Stability. 3 The Proportion.

2 The Site is the locall position of the Earth in respect of the Celestiaall Bodyes.

It might seeme a hard and almost impossible taske for any man to reconcile that which hath beene spoken in the former Chapter concerning the *Earths circular Revolution*, with the grounds of common Geographers, which hold the *Terrestriall Globe* to bee settled and fixed in the Center of the world. The reason is; because such as hold the circular motion of the Earth, (whereof the chiefe is *Copernicus*) would haue the *Sun* to stand still, as the fixt Center of the *Vniuerse*, and the *Earth* to moue round about him betwixt *Mars* and *Venus*, which seemes cleane opposite to the former opinion. I must confesse that *Copernicus*

his opinion entirely taken and vnderstood; standeth altogether opposite to these our grounds: yet may that motion of the *Earth* which we haue established in the former Chapter (for ought I yet know) bee well reconciled with their opinion, which hold the *Earth* to bee the Center of the world. For the circular Revolution wee gaue to the Terrestriall Globe, was not a motion of the Center of it, from one place to another, as that of the *Starres* which moue round about the *Earth*; but rather a turning of it selfe in its owne place, vpon her owne *Polés* and *Axell-tree*, in such sort as the wheele of a mill, or such a like engin fixt in one place is turned vpon his owne *Axell*: So that the motion wee there vnderstood was only the *Diurnall* motion of 24 houres, making the *Day* and *Night*. The other two motions mentioned by *Copernicm*, may be found out in the *Heauens*, and left to *Astronomers*. The reasons why I entirely embrace not *Copernicm* his opinion, are chiefly two. First, because it seemes too harsh and dissonant in nature, to make one and the selfe-same body subiect to so many motions, especially such as by common Philosophers is denied all motion. Secondly, because the other motions granted to the *Earth* must needs suppose it to bee placed out of the Center of the world; the contrary of which we shall in this Chapter, God willing, sufficiently demonstrate. The motion therefore most called in question, and most likely to bee found in the *Earth* rather then in the *Heauen*, is the *Diurnall* Revolution performed in 24 houres from the *West* to *East*: which (as we haue proued) being giuen to the *Heauens* would be farre swifter then nature can well suffer: wherefore with more probability may this motion bee taken from the *heauens*, and giuen vnto the *Earth*: The other without any absurdity at all may be granted in the *Heauens*: Sith no repugnancy is found in nature, but that every heauenly body may be furnished with some motion: and therefore *Copernicm* might haue granted the *Sun* and fixed *Starres* their seuerall motions as well as the rest, which would haue seemed farre more probable then to haue endowd the *Earth* with a Triplicity of motion. These things being thus opened, I will set downe their Theoremes.

The Terrestriall Globe is the Center of the whole world.

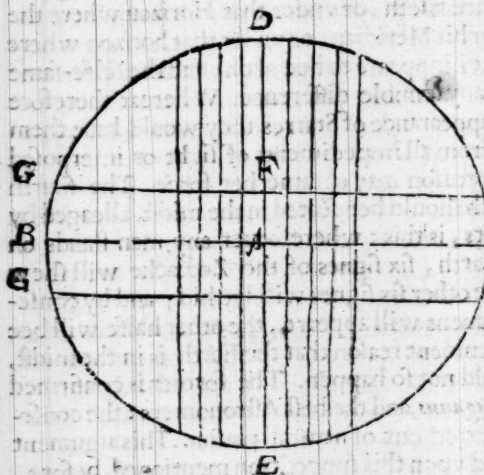
To vnderstand aright this proposition, wee must consider that a *Center* may be taken two manner of wayes: either *Geometrically*, or *Optically*: In *Geometry* it is taken for an imaginary point, conceiued in a magnitude deuoyde of all quantity, yet bounding and termining all Magnitudes: *Optically* it is vsually taken for a small and insensible Magnitude; because to the sight it may seeme no other then a *Point*; In which last sence we may call the Earth the Center: For although the *Earthly Spheare* is endowed with a great and massie substance, yet (as we shall hereafter demonstrate) in respect of the Firmament this greatnesse would vanish into nothing. For if a man standing in the Firmament should behold it, it would seeme no other then as a small point. This being declared, wee will produce these reasons to proue the Earth to be the Center of the Vniuerse. The Center, I say, not of all heauenly motions (for some Starres are moued vpon their own Center) but of the whole heauenly machine being collectively taken as one Body. The first argument is of *Aristotle*, taken from the grauity or naturall inclination of all heavy bodies to the Center. The Earth (saith he) being a heavy & massie body, must needs seeke the lowest place, which is farthest off from the Heauens. But this can be no other then the Center or middest point of the whole world. Which argument by others is more subtilly vrged in this manner. Suppose the whole masse of the Earth were cut and diuided into many parts, equall the one to the other, of the same waight and figure: which parts so diuided were placed in diuers places vnder the concaue Superficies of the Moone, that they might be freely left to themselves to moue according to their naturall inclinations: It is most certaine that all their parts being of the same nature, waight, quantity, and figure, would descend with the same motion, & in the same equall time, to the same place; which could in no wise happen, except they should concur in the Center of the world. But this reason, for ought I vnderstand, is only probable, and not backt with any necessary demonstration. For it proues not

thing else but the Earth to bee the Center of all earthie and heauy bodies, and not to bee absolutely placed in the exact middle of the world. Another reason not much vnlike the former, is drawne by some from a small cause, and the naturall harmony of the parts of the world, one with the other: The Earth (say they) is of all other bodies, the most vile, and fordid: Therefore it is agreable to nature, that it should be placed in the middle, equally distant from each part of the Heauens, that one part might not seeme to complaine of this vnpleasing vicinity more then another: But this reason takes as granted to matters, as yet not decided. First, that the Earth, amongst all other bodies, is most vile and fordid, depending on the ground of Peripateticks, that the heauenly bodies suffer no corruption, a thing sooner spoken then proued. Secondly that pure and impure bodies, the most excellent and most vile in nature, are alwayes most distant, as in nature, so in place: which is a peremptory assertion without ground. A third reason more probable then the former, is drawne from the apparences of Starres about the Horizon: It is manifest that the Starres about the Horizon appeare alwayes to bee of one, and the selfe-same magnitude, and quantity, whether in the verticall point, or in the East, or the West, or any other place: whence we may collect that they differ equally in distance from the Earth, and by consequence the Earth is seated in the middle of the world: for if it were otherwise, that the Starres in some place should bee neerer, in other farther off, they would some-where seeme greater, other-where lesser, according to the grounds of the Opticks. This reason, howsoeuer popular, seemes to admit a two-fold exception. First, because it implies that a man standing on the superficies of the Earth is equally distant from all places and parts of the Heauens; whereas the heauens in the Horizon are farther distant, by reason of a whole semidiameter of the earth interposed. Secondly, all Starres arising in the East, or setting in the West, ordinarily seeme greater then in the Verticall point, by reason of vapours ascending and interposed. Whence wee cannot well gather the Earth to bee seated in the middle from the like appearance of the Starres when experience teacheth the contrary

trary, that they seeme not alwayes of the like magnitude. Concerning the first, we answer that the Semidiameter of the earth interposed betwixt the Superficies and Center, is in it selfe greater. But this (as wee shall proue) in respect of the Heauens is so little, that the sense cannot gather any difference in obseruation of the Starres, but that they should alwayes appeare of the like magnitude. Concerning the second, wee must needs acknowledge that vapours ascending about the Horizon by an Opticall Refraction, make the Starres seeme greater then other wise they would doe. But the reason may bee vnderstood in this sort: that whether a man be placed in the same Horizon where the Sunne is when hee riseth, or vnder that Horizon where the Sunne is now, vnder his Meridian, or vnder that horizon where hee is setting, hee will appeare to bee of one and the selfe-same greatnesse without any sensible difference. Whereas therefore they speake of the appearance of Starres, they would haue them taken as abstracted from all impediments of sight or interposed vapours, and so the reason may obtaine her force. The fourth reason why the earth should bee seated in the midst, alleaged by *Ptolomie*, and others, is this: wheresoeuer any man stands on the Surface of the Earth, six signes of the Zodiacke will shew themselves, and the other six signes will lye hid; and by consequence halfe the heauens will appeare, the other halfe will bee vnder; which is an euident reason that the Earth is in the midst, for otherwise it could not so happen. The former is confirmed by *Ptolomie*, *Alphraganus*, and the best Astronomers: the consequence may bee inferred out of naturall reason. This argument will sufficiently hold vpon this supposition mentioned before, and to bee proued hereafter: That the Earth hauing no sensible magnitude in respect of the Firmament, no sensible difference can shew it selfe betwixt the *Sensible*; and the *Rationall* Horizon. Besides these reasons, which make the matter more then probable: others are produced by *Ptolomie* demonstratiue, not admitting any euident or probable exception or euasion. The first is this; If the Earth bee placed out of the Center of the world, it must haue of necessity one of these three Sites or positions: Either it must be in the plaine of the Equinoctiall: or

Ant. 12. 13.

at least it must bee placed, not onely without the plaine of the Equinoctiall, but without the Axell-tree: That is, to expresse it plainer; It must either bee placed beside the Axell-tree, yet equally distant from both the Poles; or else it must bee on the Axell-tree, and so consequently neerer to one Pole then the other: or thirdly, it must needs be beside the Axell-tree, yet neerer to one Pole then another. If the first position were admitted, these absurdities would of necessity follow. First, that in a right Spheare there would happen no Equinoctiall, but onely in that Horizon which passeth by the Center of the world: for example sake; let there be imagined a Spheare, BDCE, whose



Center is A: let the Equator bee DE: the Axell-tree of the world BC: and let the Earth bee in F, the right Horizon HG not passing by the Center of the world A: which shall bee parallell to the Axis BC: since the Equator cuts the Horizon.

in right angles; It is most manifest that not onely the equator, but other parallels of the same will bee vnequally diuided of the Horizon: for as much as it passeth not by the Center or the Poles of the world: wherefore it must needs follow, that the dayes must continually be vnequall to the nights: which contradicts all experience; because in a right Spheare the dayes are alwayes found to bee equall to the nights. Secondly, out of this position it would follow, that no man in a right Spheare

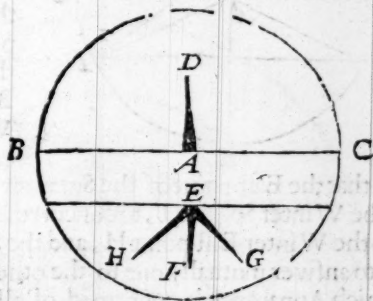
should

should behold the halfe or hemisphære of the heauens, but either a greater or lesser part, as may be demonstrated out of the same Diagramme, whereas sense can testifie that six signes of the Zodiacke are alwayes conspicuous aboue our Horizon, and the other six alwayes hid: only excepting that Horizon which passeth by the Center of the Earth, wherein the Mediety of Heauen is conspicuous. Thirdly, the same Starres in a cleere aire should not alwayes seeme of the same magnitude; for if the earth be placed in the Equinoctiall plaine, and beside the Axis of the world toward the Zenith or Meridian; the Starres which are in the Meridian will appeare greater then in the East or West, because they are neerer. But if it bee placed neere the Nadir or midnight point, they will appeare greater in the East or West, then in the Meridian: if it should bee placed towards the East or West, the Starres would either seeme greater in the East then in the West, or contrarywise, greater in the West then the East: all which plainly contradicts experience. Moreouer it would hence follow out of this last, that the fore-noone would not be equall to the after-noone, for as much as the Meridian circle passeth by our verticall point, which in this case cannot bee in the middle of the hemisphære, but will decline more, either to the East or the West. Fourthly, it must needs follow that in an oblique Spheare, either there will bee no Equinoctiall at all, or at least, if there were any, it would not be in the midst betwixt the two Solstices of Summer and Winter; which is against all common experience. To explaine which assertion, let there be a Spheare ABCD, whose Center shall bee E: wherein wee will conceiue the equatour to be BD: the two Tropicks IL, and XH: the Axell-tree of the world AC: Now if the Earth should be placed in the plaine of the equatour, out of the Axis of the world, as in F let there first be an oblique Horizon ZFY, cutting all the parallels into vnequall parts, and the Axis in those parallels which are without: it is manifest that in the said Horizon there will bee no Equinoctiall; because the Horizon equally diuides in two halfes only that parallell which is described by P, which neuerthelesse the Sunne neuer comes vnto, as neuer going beyond the Tropicke XH: Let there bee another

I Q, is exceeded of the Equinoctiall day I K. All these absurdities are avoided, if wee put the Earth in the Center E. for so in every oblique Horizon, as in SR, will bee an Equinoctiall, the Sunne rising in the Equator. 2 The Heavens will bee divided into two equall halves, and P G the excess of the longest day, will bee equall to K V, the defect of the shortest day: whence wee may conclude the first part of this argument, that the Earth is not besides the Axis in the plaine of the Equinoctiall. Concerning the second position: if wee should place the earth in the Axis of the world out of the plaine of the Equinoctiall, as many, or more absurdities would of necessitie follow: for example sake, let it be imagined in P: First then no Horizon beside a right would cut the Heavens into two equall parts or halves, and consequently the Zodiacke. But this is proved false by experience (as we have shewed) because six signes of the Zodiacke are alwayes above and conspicuous, and the other six vnder. Secondly onely vnder a right Horizon would there bee an Equinoctiall, because only such an Horizon equally diuides the Equator into two halves, as may bee seene in the former figure, in which the Equator is conceaied to bee BD: the right Horizon AC. the oblique YZ, cutting the Equator in F into two vnequall parts: Now if it should happen that in any oblique Horizon, there should bee an equinox, it could no wise bee in the middle time betwixt the two Solstices, but would be much neerer to the one then to the other; as if the Earth were placed in N, betwixt the Tropicke XH, and the Equator BD, there would bee an equinox when the Sunne passeth in the parallel by N. which parallel is farre neerer to the Summer Solstice, then the Winter Solstice. But if the Earth were in G, there would happen an equinox iust in the day of the Summer Solstice; all which are most absurd, and most repugnant to common sense. Thirdly, this granted, the whole order and proportion of increase and decrease of dayes and nights, would bee confused and troubled. It is agreed on by consent of all Cosmographers, that euery where without the right Horizon, there is such an order and proportion of the increase & decrease of the dayes and nights, that twice in a yeere the dayes are equall to the nights; to wit, in the meane,

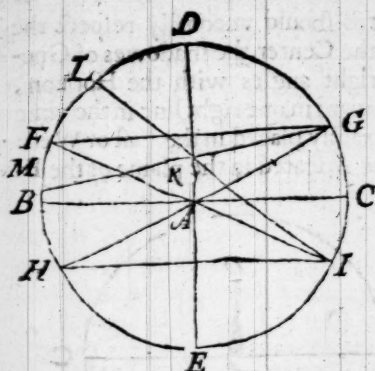
or middle betwixt the longest and the shortest day, that the longest day is equall to the longest night, and the shortest day to the shortest night. That the excessse of the longest day above the Equinoctiall day, is so much as is the defect of the shortest day in regard of the said Equinoctiall day. All which and many more such Apparences would bee interrupted, were the Earth placed any where else then in the Center E; as will appeare by the Scheme. For the Earth being placed in E, euery oblique Horizon, as S R, will diuide the Equatour B D, into two equall hemicircles, so that so much shall appeare aboue as lies couched vnder, and so that day will bee equall to the night. In like sort the Tropieks H X and I L will bee diuided into two vnequall parts, yet so as the Alternate segments shall bee equall, to wit, P X and V L, also T H and V I, as it is demonstrated by *Theodosius, lib. 2. prop. 16*. Whence it comes to passe that the longest day X P is equall to the longest night L V, and the shortest day I V is equall to the shortest night H P. Finally, P G, the excessse of the longest day X P above the Equinoctiall day X G, is equall to K V the defect of the shortest day vnder the Equinoctiall day I K, which is shewed out of the similitude and equality of the Triangles T E G, and V E K. Now of the contrary parts, if the Earth should be placed in the Axis without the Center E, as in P, beyond all the parallells, no equinoxe can bee in an oblique Spheare (as wee haue shewed) but alwayes the dayes will bee longer or shorter then the nights. But if the earth bee placed in the point G, by which passeth the last of the parallells, there will be one only equinoxe, & that in the Solstice in an oblique spheare in all other parts of the yeere the dayes would either be longer, or else shorter then the nights, But if the Globe of the Earth bee seated within the parallells in the point N, there would be two Equinoxes in a yeere, wherein the spaces of dayes and nights should increase and decrease. Neuertheless these increments & decrements should neither in number nor in greatnesse be equal to the increments and decrements of the nights, as may be gathered very easily by sense, comparing the two Triangles, D N G, and Q N K, because that more and greater segments of parallells are comprehended in the Triangle L N K, then in the Triangle P N G.

PNG. Fourthly, if the Earth should vnequally respect the Poles, and were not placed in the Center, the shadows of Gnomons erected which make right angles with the Horizon, should not bee cast directly forward in one right line in the time of the Equinoxes: the Sunne exactly placed in the East or West: as for example: let the earth be A, seated in the plaine of the Equinoctiall circle B C and let there bee a Gnomon erected on the plaine of the Horizon, which is represented by the circle B C: It is manifest to sense that the sun setting in C, the shadows will be cast in the opposite part towards B. Likewise the



Sunne rising in B will cast his shadow towards C. But A C and A B, concur in one right line, which plainly demonstrates vnto vs, that the earth is seated in the plaine of the Equinoctiall. But if it were placed out of it towards either side, as in E, if a Gnomon be set vp on the Horizon as E F, wee shall see that the Sunne rising in B in the time of the Equinoctiall, the shadow will bee directed by the line E G, likewise the Sun setting in C, the shadow will make the right line E H: But these two right lines being produced, will cut one the other in the point E, and therefore cannot concur in the same right line, wherof ordinary experience witnesseth the contrary. Fifthly, if the Earth were thus placed, it would follow by necessary consequence, that two signes of the Zodiacke diametrically opposite, should not be seene by a Dioptricke instrument: which is against experience which witnesseth that the rising and setting of the Sunne, may be seene by one right line: also the rising in the Summer Solstice and the setting in the Winter Solstice, to answer to each other in one right line in euery Horizon: which could not bee performed vnlesse the Earth were in the Equinoctiall plaine and the

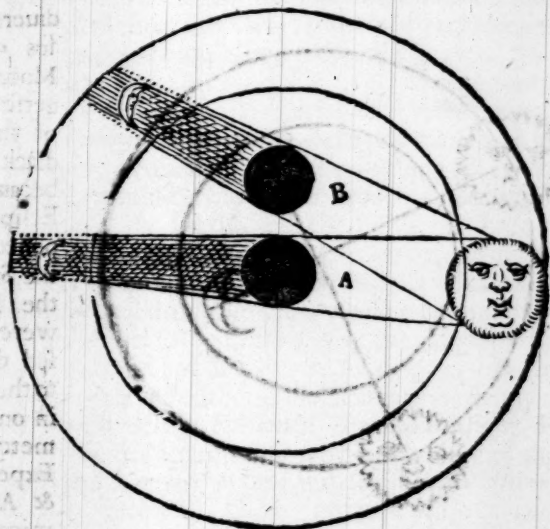
Center.



Center. Let there bee an Horizon $BDC E$, the Equator BC , the Axle-tree of the world DE , the Tropicke of Cancer FG , of Capricorne HI . Let the Earth first bee placed in the Center A : here may plainly bee perceaued that the Equinoctiall East B , and the Equinoctiall West C , answer and concurre in the right line BC :

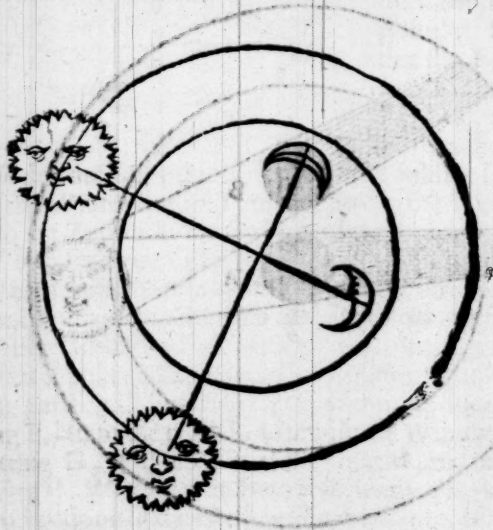
also that the East point of the Summer Solstice F , and the West of the Winter Solstice I , to concurre in the same right line FI , also the Winter East point H , and the Summer Westerne point G , to answer mutually one to the other by the same line GH . Which Apparence is confirmed of all Astronomers. Now let the Earth be set in the Axis out of the Equatour in K : It is manifest to sense that the contrary will alwayes happen: For the Winter point of the Sunne setting I , by a right line drawn from the Earth will not directly answer to the Summer point of rising F , but to the point L . Likewise the Winter point of Sunne-setting G , will answer to the point M , and not to the Winter rising H . Whence wee haue sufficiently demonstrated this second position of the Earth beside the Center of the World to be inconuenient, and no wayes to bee defended. For the third position that the earth should be so remoued out of the Center, as that it should neither be in the Equinoctiall plaine, nor yet in the Axell-tree. Wee need produce no other confutation, then what wee haue said before of the other two positions. Because out of this, the same or greater absurdities would follow, then of the other, as any man may easily vnderstand out of these demonstrations wee haue before recited. The second demonstratiue reason, wherewith *Ptolomy* would confirme the Earth to be in the Center is drawne from the Eccclipse of the Moone in this manner. If the Earth were not in the Center of the World, there would

would not alwayes happen Eclipses of the Moone, when the two greater lights are diametrally opposed, but sometime they would happen when these great lights are not residing in opposite places of the Zodiack, which is false, and against experience; for all Astronomers have witnessed, that eclipses of the Moone then only are seene, when the Sunne & the Moone stand direct-



ly opposite the one to the other: because then is the earth directly interposed. Now let the Center of the world be A; in which if the Earth bee placed, it is manifest that it then happens when the Sunne and the Moone are exactly opposed, and the earth interposed directly, which in this case cannot otherwise happen: But if the Earth bee placed beside the Center of the world, as in B. These things may fall out, that the two Luminaries may reside in two opposite points of the Zodiack, and yet cause no eclipse; because the Earth is not in the same Diameter by the which they are opposed. Also the Moone will sometimes suffer

an Eclipse, when shee is lesse distant from the Sunne then a semicircle. In a word, this eclipsse is in places opposite. A semicircle will then only be seene when the Diameter of opposition shall passe by the Center of the Earth, and the world; all which are manifestly repugnant to experience and obseruation. Out of this demonstration of *Ptolomy*, *Clavius*, a later Astronomer in this sort drawes the like conclusion. Let there be obserued two

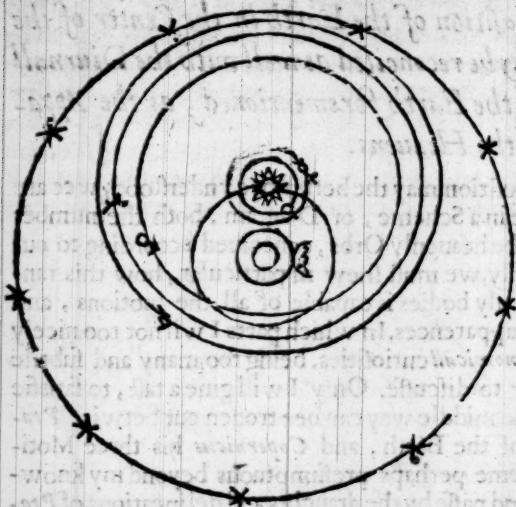


diuers eclipses of the Moon in diuerse places of the Zodiac: Now because each Eclipse happened when the Sun and the Moone were opposed the one to the other, in one Diameter (as Experience & Astronomical sup-

putations warrant) it must necessarily bee concluded that the earth should bee in each of those Diameters, and so by consequence in the common section of them both: Sith then all the Diameters of the world concur, and cut one the other in the Center: it must needs follow that the Earth should bee in the Center and midst of the World. Diuerse reasons there may bee drawne to proue this assertion. But these demonstrations of *Ptolomy*, as I haue set them downe enlarged, and explained by our later writers, may seeme sufficient, especially in a matter of few called in question.

The Position of the Earth in the Center of the World may be reconciled as well with the Diurnall motion of the Earth forementioned, as the Apparences of the Heauens.

That this proposition may the better bee vnderstood, wee are first to set downe in a Scheme, or Diagram, both the number and order of all the heauenly Orbs, conceiued according to our grounds. Secondly, we must shew in particular, how this ranging of the heauenly bodies is capable of all the motions, and apt to satisfy the apparences. In which parts I will not too nicely descend to *Astronomicall* curiosities, being too many and subtile for a *Geographer* to discusse. Only I will giue a talt, to satisfie such as suppose no middle way can bee troden out betwixt *Ptolomies* stability of the Earth, and *Copernicus* his three Motions. I might seeme perhaps presumptuous beyond my knowledge, to reiect and passe by the draughts and delineations of *Ptolomy*, *Alphonfus*, and their followers, which are commonly defended and in vse: or that other of *Copernicus*, supported with the authority and credit of so great an Astronomer: or that of *Tichobrah*e more corrected then either, and to preferre my own, being an Embrion, or halfe fashioned. To this I answer. First, that I only expose this Scheme following to the view of the iudicious, iustifying it no farther then will stand with *Astronomicall* obseruation. Secondly, I herein arrogate little or nothing to my selfe; for as much as I haue digested, and compounded it out of the obseruations and experiments of late Astronomers, and only collected together what they scattered; The Scheme it selfe is expressed in this manner; wherein to beginne from the lowest: The Center is the Globe of the Earth, to which wee haue giuen a *Diurnall* motion from the West to the East vpon her owne Poles, whose Reuolution is made in 24 houres: About the Earth as the Center of the whole world, the Moone is carried in her circle, which amongst all the Planets, is found more neerely to respect the Earth, as well in place as nature. Next succeeds the Sunne, as the leader of all the Planets, which carried



ried round about the earth in an *Annua* circuit, describes the *Ecliptick* circle: about the *Sun* as the proper Center, are all the Planets moued except the *Moon*. The two immediate companions of the *Sun* are *Venus*, & *Mercurie*, which so compass him

about, that the *Earth* neuer comes betwixt them and the *Sunne*. The other three Planets, as *Mars*, *Iupiter*, and *Saturne*, howsoeuer they enuiron the *Sunne* as their proper Center, yet so as within their circles, they comprehend the body of the *Earth*: The Planet *Mars*, because hee is found by Astronomers, to moue sometimes aboue, sometimes vnder the *Sunne*, is vnderstood to moue in such a circle, which on the opposite side shall cut the circle of the *Sunne*: yet so as *Mars* and the *Sunne* can neuer meet in one point: Forasmuch as *Mars*, as well as the other Planets, is supposed to be carryed in an Epicycle about the *Sunne*, and to keepe an equall distance from him howsoeuer moued: Neither is he euer found vnder the *Sunne*, but about the time of the opposition, as Astronomers obserue: whence a cause hath beene given, why *Mars* should appeare greatest at the time of *Opposition*. These five Planets, to wit, *Saturne*, *Iupiter*, *Mars*, *Venus*, and *Mercury*, may bee considered according to a double motion: The one is proper and naturall, wherein they are moued about the *Sunne*, as their proper Center: The other Accidentall, and as it were by a consequence of Nature, where-
by

by in their circuit mouing about the *Sunne* as their Center, they must of necessity, by a consequent site of the place, be carryed about the *Earth*. For the *Sunne* placed in his *Eclipticke* line, so compasseth round the *Earth*, that with him hee is supposed to carry the *Epicyles*, wherein these Planets are moued round about him. Whence wee finde the motion of these Planets about the *Sunne*, as their owne Center, to bee regular, but about the *Earth* irregular: which proceeds from their *Excentricity* in respect of the *Earth*. Aboue all the Planets wee place the *Firmament*, or Starry Heauen, hauing a very slow motion, not to bee finished in many thousand yeeres, and this motion is on other Poles then the Poles of the world, to bee sought out in or neere the Poles of the *Eclipticke*. This Heauen would *Aristotle* haue to bee the first moueable, and therefore gaue it a very swift motion, which is the same which wee call *Diurnall*, and haue giuen to the *Earth*. But it seemes more consonant to nature, that the slower motions should agree to the higher bodies: and the swifter to the lower, that there might be a proportion, betwixt the time and the space of motion: It remains that wee probably shew that out of their suppositions, the Celestiall Apparences may bee as well or better salued then by the ordinary grounds. The Apparences which are most called in question, concerne either the *Motion*, or the *Places*, and Positions. All the rest are either of lesse moment, or at least are therein to reduced. Euery motion which is found or thought to bee found in the Heauens, is either the *Diurnall*, or *Periodicke*. The *Diurnall* Motion (as wee haue already shewed) belongs to the *Earth*, which according to our grounds is supposed to moue from the West vnto the East in 24 houres. Which may answer to the Motion of the first moueable Spheare; which according to *Aristotle*, is the Starry Firmament, and thought to moue from the East to the West. The *Periodicke* Motion, is either a slower Motion, to be finished not vnder many thousand yeeres, or else a swifter Revolution of the Planets. This slow motion the common Astronomers would haue twofold: The one from the West to the East on the Poles of the *Eclipticke*: the other a Motion (as they call it) of *Trepidation*, from the South point to the North

and backward againe: but one slow Motion of the fixt Starres vpon the Poles of the *Eclipticke*, granted to the Firmament, will (for ought I see) satisfy both. The reason why they put two distinct Motions, is, 1. Because they haue obserued the Starres of *Aries*, *Taurus*, and the rest of the *Zodiacke*, not to be seated in the same place wherein they were anciently found; but to be moued certaine degrees from the West towards the East. Whence they would conclude a Motion to bee from the West vnto the East. 2. It will stand with no lesse experience, that the foresaid Starres of the Firmament haue moued themselues from the South towards the North. To passe ouer the rest, the *Pole-star*, which in *Hipparchus* time was distant from the Pole about 12 Degrees, is now obserued to approach almost three degrees. These two Motions, should they bee esteemed in the account of Astronomers might seeme deficient. Notwithstanding wee may probably coniecture this to bee no other then one, and the selfesame Motion vpon the Poles of the *Eclipticke*: Whence it may come to passe, that the fixt Starres are not only carryed from West to East, but also by reason of the obliquity of the *Eclipticke* line, encline more and more dayly to the Pole of the *World* whence they may againe returne. For this motion from the West to the East, is of the primary intent of nature, wherein the Starres moue in circles parallel to the *Eclipticke*: But from the North to the South, as by the necessary consequence of the position and obliquity of the *Zodiacke*: because it cannot bee auoided, but that it should either incline to, or decline from the Pole. If they should obiekt (as many doe) that this progresse is not proportionall in respect of the time according to the calculation of the Astronomers. Wee answer. 1. That this difference is so small, that it should rather seeme to bee imputed to the negligence or ignorance of such as tooke these obseruations, then to any diuersity of motion. For who knowes not in these dayes of ours, wherein this art is arrived at a farre greater perfection, diuerse Astronomers in obseruing the same Star at the same time, to differ much the one from the other: Whose knowledge notwithstanding, is fortified with the experience of the Ancients, and inuention of new Instruments. What then shall wee thinke

of

of those, which distant so many ages in time, and vsing diuerse & vnlike Instruments in their obseruations, haue differed in matters of so small moment: chiefly in seeking out the period of this long and slow motion, which by reason of his slownes, since the time it was known to man, hath not ranne the fifteenth part of his circle. For my part, I shall rather ascribe it to the error of their obseruations, then multiply Orbs without a greater cause. First, because (as wee haue said) the difference is so small, and almost insensible. 2. Because wee haue beene taught by our Astronomicall histories, what kinde of Instruments were then in vse, which to later Astronomers haue beene thought too rude and vnfit to make such subtile obseruations. Lastly, concerning the *Site* and *Position*, no lesse reason may bee giuen out of our *Hypothesis*, then the common way. For by placing the five Planets to runne in their Epicycles about the Sunne, may we giue a reason of the inequality of their distance from the Earth, wherein an ingenious minde in our common grounds can hardly giue himselte sufficient satisfaction.

3 The *stability* is an affection whereby the Terrestriall Spheare is firmly settled in his proper place.

The *Stability*, or firmenesse of the Earth which we here vnderstand, 1. No way denyes or contradicts the motion of the parts of the Earth, whereby being separated, they returne to their proper place. 2. Neither the circular Reuolution of it on her owne Poles and Axell, whereof wee haue formerly spoken. But either such a motion whereby the parts of it may bee seuered one from the other, and so the whole Masse dissolued; or whereby the Center of the Earth may be moued out of his proper place; or at least such as might mooue the Poles of the earth from their true verticity, whereby they should not respect alwayes in the Heauens the same points or poles. Which kinde of stability from motion we will establish in this Theoreme.

1 The Earth is firmly seated and settled in her proper place.

This Theoreme may bee proued as well by reason, as authority of holy Scripture: From reason it is demonstrated in this manner. If the Earth should not be settled in her proper place, this would of necessity happen; either by dissolution and separation of the parts one from the other: or by removing the poles out of their fixt places: or else by motion of the Center from one place to the other. The first cannot be admitted; because (as we haue before taught in the second Chapter of this booke) All *Terrestriall* Bodies are endowed with an inclination or ponderosity to approach as neere as they can to the Center of the Earth; so that by this coherency and conformity, the whole earth is ransom'd from any such mutability. Neither can the whole Spheare be dissolued without an especiall miracle: And ifso it should happen, the parts would returne againe, and conforme themselves to compose the same Spheare. Likewise the second way; The earth cannot loose her stability, because (as wee haue shewne in our former Chapter) the earth hath her two Poles magneticall made fast vnto the Poles of the world, as if they were bound firmly to two great pillars, neuer to bee shaken. Finally, The Center of the Earth cannot be moued out of his place any wise, because, as we haue demonstrated in the Chapter before, without the disturbance and inuersion of the whole frame of Nature the Earth can haue no other place then the Center or middest of the whole world. Some haue alleaged as an argument that principle of *Aristotle*: *That one simple Body can haue but one simple Motion*: and therefore the earth challenging to it selfe a right motion to the Center, cannot also haue a circular or round motion, and so of necessity must rest vnmoued in her proper place. But this reason, as I haue shewed, is weake to proue this assertion. First, because this principle of *Aristotle* is not grounded on certainty, but contradicts experience, as I haue elsewhere shewed. 2. This right motion to the Center is not to bee ascribed to the *whole*, as the immediate subiect, but to the *parts* of it separated from the whole; so that nothing will hinder, but that the whole Globe may haue a motion proper to it selfe on his owne Poles. But to let this reason passe as weake; all those arguments alleaged by the common Astronomers, and Philosophers against

against the circular motion of the Earth prone indeed no other matter then this stability which we establish : but if racked any farther come short to satisfie. For authority of Scripture , many places are vrged to proue this stability ; whereof wee haue a pregnant place in 104 Psalme , wherein *Dauid* magnifying the Creator, saith *That hee laid the foundation of the Earth so sure, that it should not be moued at any time* : To which may be added many other Texts , but that I hold this one sufficient in a matter which few men call in question. Wee are in the third place to treat of the proportion of the Earth, with the heauenly bodies.

4 *The Proportion* is that wherein the quantity of the Terrestriall Globe is compared with the quantity of the Heauens.

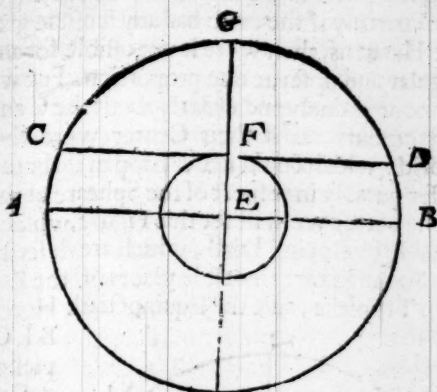
We must here remember a distinction before touched, that the Globe of the Earth may bee considered two wayes; either *Absolutely* in it selfe, or *Comparatiuely* in respect of the heauenly Bodies. If we consider it absolutely in it selfe, wee shall finde that the Earth hath a vast and huge magnitude, and not any wayes to bee compared to a point ; because it is a body , and therefore subiect to diuision , whereas a point is conceaued as an indiuisible signe admitting no parts at all. Secondly, because the magnitude of the Earth many times taken , will measure the greatness of the Heauens , as wee may obserue by Astronomers who measure the magnitude of the greatest Stars by *Diameters* and *Semidiameters* of the Earth : whereas a point of it being a thousand times multiplied , will neuer beget a magnitude or measure of the quantity of any Body. Thirdly , the Starres are not as meere points in respect of their Orbs, because they sensibly are scene, as parts of these Orbs. But the Earth is greater then some of the lower Starres, as the *Moone* : Whence we may with good grounds auerre , that if a man were placed in the *Moone*, hee might behold the *Earth* far greater then the *Moone* being obserued by vs in the Earth. Wherefore no man can deny but the Earth in it selfe hath a great vastnesse. But if wee consider this greatness in respect of the Heauens, we shall find this vast greatness to shrink almost into nothing, and become as a

meere point without sensible magnitude. But this is not altogether generall without limitation; because the heavenly bodies are distinguished into the higher and greater, such as are the Firmament with the foure higher Planets, such as are *Saturne*, *Jupiter*, *Mars*, and the *Sunne*: or the lower and lesser, such as are *Venus*, *Mercurius*, and the *Moone*, which difference in place and greatnesse admits a great diuersity in this proportion, as wee shall shew in these two Theoremes.

1 *The Earthly Globe compared in quantity with the Firmament and superiour Orbes of the planets, hath no sensible magnitude.*

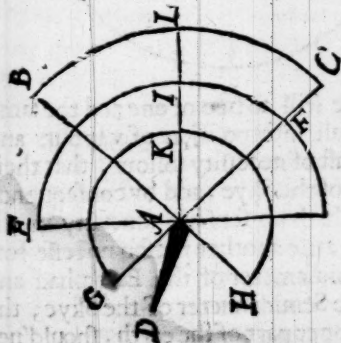
This Proposition is supported not only by the authority of many and graue Authors, as *Aristotle*, *Ptolomy*, *Pliny*, *Alphragan*, and others: but by diuers strong reasons drawne from experience and obseruation of Astronomers. The first argument shall be this, which is most popular. The *Sunne* and many other Starres in the Firmament, are found out by Astronomicall Instruments to bee manifold greater then the Globe of the Earth: yet appeare they in respect of the heauens but as a little point or portion. Then must the Earth, being in comparison far lesser, be deuoyd of all sensible magnitude or proportion. Secondly, if the Earth had any notable quantity in respect of the Heauen, then must the *Diameter* of the earth haue as great a quantity in respect of the *Diameter* of the Sky; for there is the same proportion of the Diameters which the circumferences haue one to the other, as is demonstrated in Geometry. Now if the *Diameter* of the Earth hath any notable magnitude in coparison of the *Diameter* of the Skye, then the Starres which be ouer our heads, be neerer vnto vs by a notable quantity, then when they bee either in the East or West. For it must needs follow that the Starres placed in the verticall point, are neerer by the *Semidiameter* of the Earth, then when they are either in the Easterne or Western point, as we see in this figure here set downe ACDB, wherein I make B to be the Center of the Earth, AEB the true Horizon, and EF the *Semidiameter* of the earth. Now if the *Semidiameter* FE haue any sensible proportion, then must G the

the verticall point
be neerer to F then
either A or B. sup-
posed to bee the
East & west points;
because E A, or
E B, are the whole
Semidiameter of
the Celestiall cir-
cle, whereof F G
is only a part. But
contrarywise there
is no such diuerfi-
ty perceived in the
magnitude of the



Starres, but that they appeare still to bee of one and the same
greatnesse, except by accidentall interposition of vapours and
grosse bodies: wherefore it must of necessity follow, that their
distance is all one in all parts of the Skye, and by consequence
the Semidiameter of the earth hath no sensible diuersity in di-
stance. Thirdly, hence would arise another reason no lesse for-
cible then this; that if the Semidiameter of the Earth had any
comparison or proportion to the Semidiameter of the Skye, the
Horizon that we haue on the vpper part of the earth, should not
diuide the Skye into two equall parts; for as much as the part
which is couched vnder the Horizon, would alwayes be greater,
and the other lesse, as in our former Diagramme: if E F haue a
notable quantity in comparison of E A: then will the line
C F D, being the Horizon on the top of the earth, differ notably
from the line A E B, being the Diameter of the World,
and the Horizon to the Center of the Earth: and so shall not the
Horizon C F D, diuide the world into two equall parts, but the
vpper part shall alwayes be lesse then the lower, which crosses
ordinary experience: for we may see in long winter nights, that
those Starres which are in the East Horizon, in the beginning of
the night, will be in the West at the end of twelue houres: and
contrarywise, those Stars which did set in the West, when those

others did rise in the East, shall rise agayne when the other shall set. Fourthly if the earth had any sensible greatnesse in respect of the Heauens, then were it vnpossible for any Sunne Diall to bee regular and obserue due proportion. For we see the shaddowes to moue as duely and orderly about the Center of Dials and such instruments, as if their Center were the very Center of the world: which could neuer happen if these two Centers should differ notably in respect of the Spheare of the Sunne: to expresse it the better we will set this Figure, which represents the three notable circles in a Diall, which are described by the course of the Sunne in three notable places of the Zodiacke, to wit, the two Tropicks, and the Equinoctiall. Herein the vttermost arch

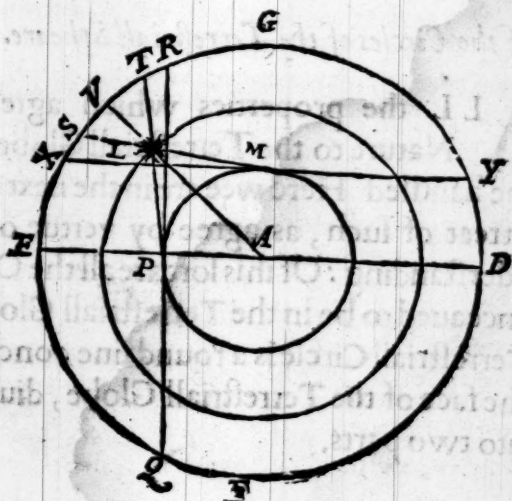


B L C represents the Tropicke of *Capricorne*, and is described no greater then the quarter of a circle, because the Sun placed in the Signe, shines vnto vs but six houres. The Equinoctiall is set as halfe a circle, because the Sun being in it, appears vnto vs 12 houres, & is here noted out by E I F. The Tropicke of *Cancer* contains 3 quar-

ters of a Circle, because when the Sun is in it, there are eighteen houres from Sun-rising to Sun-set: and that circle is G H K. The Center of the Diall is A, and the Style which giues the shadow D A, whose top being D, doth describe those portions of circles with such exactnesse, as if the Diall were set in the very Center of the Earth, and the distinction of the houres shewes it selfe no otherwise then if the Center of the Diall were the same with the Center of the world. To these arguments I may adde, that if there should bee a sensible greatnesse of the earth in respect of these superiour Orbes, either all or most of these absurdities would arise which follow their opinions, who place the Earth out of the Cēter of the World, which we haue before treated of.

2 The Terrestriall Globe compared with the inferior Orbs bath a sensible magnitude.

Although the whole Earth compared with the Firmament and superiour Orbs of the Planets, seeme no otherwise then a point: yet from this wee must except the Orbes of the lower Planets *Venus*, *Mercury*, but especially the *Moone*: Who are found by obseruations of diuerse skilfull Astronomers to haue a sensible and notable greatnesse in respect of the earth, whereof a manifest argument may bee drawne from the Parallax or variation of the sight: wherein our obseruations of the same Starre at diuerse places are not the same, though at the same time: neither will such a Starre to both places seeme in the same point of the Heauens; which could not possibly bee, except we admit a sensible difference betwixt the *Rationall* and *Sensible Horizon*; and so grant the Earth, in respect of such Orbs, some quantity and greatnesse. This diuersity of Aspect, which they call the *Parallax* may be seene in this Figure: let A be the Center of the Earth, I the Moone, or other Starre to bee obserued,



EGD.

E G D, the *Firmament* or Orbe of the fixt Starres : suppose then the eye to be in the fixt point M of the sensible *Horizon* X M Y the said Planet will appeare in the point of the Firmament S, according to *Opticall* principles, whereby all things are sayd to be seene in the place directly opposite. Supposing againe the Eye to be in the point P of another sensible *Horizon* R P Q, the Starre L will no doubt appeare in the opposite point T. Neither of which meets with the Starre in the right place. For imagining the Eye to bee placed in the Center A, the place of the Starre would bee V, which is his true place. These differences of sight could finde no place if the Earth were as a meere point and challenged no sensible Magnitude, in respect of these inferior Planets: and yet experience of Astronomers bath sufficiently confirmed it. But this being a point very curious, and appertaining to Astronomy, I leaue it to their farther industrie, whose profession it vndergoes.

C H A P. VI.

Of the Circles of the Terrestriall Spheare.

- 1 ALL the properties which agree by Nature to the Terrestriall Globe, we haue handled. Here wee are in the next place to treat of such, as agree by vertue of our vnderstanding : Of this sort are all the Circles conceaued to be in the Terrestriall Globe.
- 2 A Terrestriall Circle is a round line conceiued in the face of the Terrestriall Globe, diuiding it into two parts.

A Circle is considered two manner of wayes : either abstracted from this or that sensible matter , in which sort it is supposed to bee taught in *Geometry* ; to which properly appertaines the knowledge of the *Fabrick* and *Measure* of all Magnitudes , especially of this, being amongst all , the most perfect and exact : Or else a circle is considered so far forth as it hath some ground in the Nature of the Earth, at least by application of the Celestiall Globe , and so it comes into the consideration of *Geography*. For conclusions demonstrated and proved in *Geometry* , are here to be admitted as principles supposed not demonstrated a new : which *Logicke* , if *Clavius* , *Blancanus* , and other such writers had well learned , they would not have stuffed out their worke with such *Heterogeneall* mixtures, but have reduced euery thing to his proper seat and science. A circle as well by the *Geographer* as *Astronomer* is diuided into foure quadrants , each quadrant into 90 degrees, all which make vp 360. So that a degree is the 360 part. of a Circle , which I only mention as being of chiefest vse with vs, yet supposed to bee handled and taught in a higher science.

I *A circle though imaginary in it selfe, hath his ground in the Nature of the Earthly Spheare.*

As in *Logicke* men haue inuented certaine Intentionall Notions , seruing as so many instruments to direct and regulate our vnderstanding in the apprehension of things : So in *Cosmographie* can there not be wanting such imaginary signes and circles to confirme and ayde our phantasie. And as in *Logicke* such Notions in themselves are meereley imaginary and intentionall , yet may be teamed reall , so farre forth as they are grounded in the things themselves ; so may we speake of these circles conceiued in the face of the Terrene Globe : which wee are not to conceiue to bee fictitious and imaginary , as if they had no ground at all in nature. For although there bee no such circles painted on the face of the Earth , as wee finde in an artificiall Spheare : yet must wee of necessity conceane such reall respects to bee in the Earth it selfe : as when a Ship sayles ouer the Ocean , it cannot bee said to leaue behind any visible marke or Character in the

the surface of the water ; yet in regard it made a reall passage, it will leaue a line conceiuable, signing out vnto vs the true passage. It is a matter which hath not a little troubled *Cosmographers*, to finde out the immediate and true subiect or ground of these circles; whether they should be immediatly taken from the earth, or else in the Heauens. The ancient *Cosmographers* haue acknowledged no other ground of these Circles; then the congruity and application of the celestiall Globe, and his parts with the parts of the Earth: but our Magneticall Philosophers more neerely searching into the nature of the Earthly Spheare haue found these Circles all (except the Horizon) to wit, the *Meridians*, and *Parallels*, to bee immediatly grounded in the Earth it selfe: whose opinion we cannot reiect, as being supported by experimentall demonstration, as wee shall shew in particular.

- 2 *The distinction of a circle into any certaine Number of parts, hath no certaine ground in the Nature of the earthly Spheare, but only inconueniency; leauing our iudgements free, to take such a Number as may best serue our purpose.*

Some Astronomers more curious then wise, haue gone about to seeke a ground of this distinction of a circle into 360 parts out of the Sunnes course in the *Zodiacke*, a Circle (say they) by the opening of the Compasse, being described in a plaine, is diuided into six equall parts. Now because the Sunne being the rule and measure of all perfect motions, passeth through one sixth part in 60 dayes, the whole Circle was diuided into 360, for 60 multiplied by 6, will produce that number. But this reason seemes to infer nothing concerning any naturall ground, that this distinction shall finde in the Earth, though it may serue as an argument of Conueniency, the number 360 being fittest for that calculation. Another reason very like the former, is drawne from the coniunction of the Sunne with the Moone, which

which happens 12 times in a yeere : and because from each conjunction to that which followeth are spent 30 dayes ; Hence it is that the Zodiacke is first diuided into 12 parts , which multiplied by 30 will produce 360. This reason likewise proues only thus much, that it is the fittest number to calculate the Motion of the Sun in his Eclipticke : Not that this diuision hath any ground in Nature more then other , because being a continuat quantity, according to Philosophy , it may suffer infinite diuisions : for it was in the beginning left free to Cosmographers , to choose what number they pleased to expresse the parts or sections of a Circle : which they tooke (as it seemeth) not meerey from the motion of the Sunne , but from their conueniency , and commodity, finding this number most commodious for the distinction of euery Circle. The reason was , because no number could be found, which suffered more parts and diuisions then this. For as much as in 60, whereof 360 by multiplication is produced, hath exactly these parts 1. 2. 3. 4. 5. 6. 10. 12. 15. 20. 30. Likewise 360 hath exactly 1. 2. 3. 4. 5. 6. 8. 9. 10. 12. 15. 18. 20. 24. 30. 36. 40. 46. 60. 72. 90. 120. 180. Of all which parts there is so great vse in Astronomy and many times in Geography, that without it there would be small exactnesse. For as we see a yard measure would little steed the Mercer or Clothier , except it were againe diuided into smaller parts : so fals it out in the account of the Cosmographer.

3. Of the Terrestriall Circles, some are *Absolute*, some *Relative* : the *Absolute* are such as are assigned without any respect to our sight, of which sort are the Meridians and Parallels.
4. The Meridian is a circle drawne by the Poles of the world and the verticall point of the place.

The Meridian Circle is so called of *Astronomers*; because when the Sun (according to their suppositions) by the motion of the
first

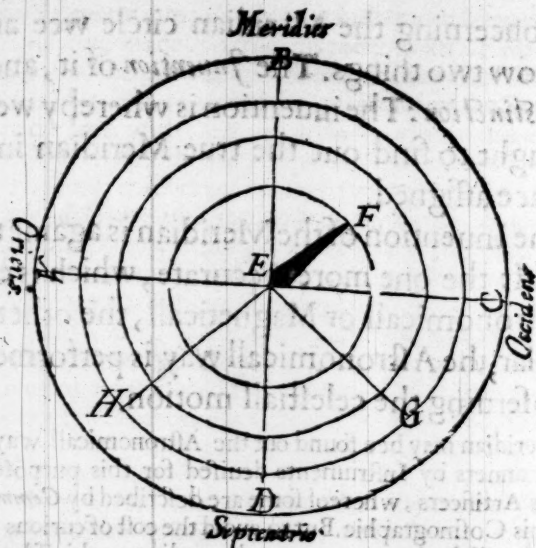
first moueable comes into this Circle, it makes mid-day: and then hath been running his course from his rising to arriue there iust so long as he shall be mouing from thence to the place of his setting. In this Meridian are placed the two Poles of the Equator, which are the same with the Poles of the world; in this also are the verticall point and the point opposite vnto it, tearmed the Poles of the Horizon, whereof we shall speake hereafter. So that so many Meridians are imagined to be in the Earth, as there are verticall points: for howsoeuer we see not many Meridians painted on the face of the artificiall Globe, yet must there be so many imagined in the reall Earth as *Zenithes* and *Horizons*: so that it is impossible for a man to moue neuer so little from East to West, without changing his Meridian: yet for more order sake haue the Cosmographers reduced the number of Meridians to halfe the number of the degrees in a Circle, to wit, to 180, that euery Meridian cutting the Equator, and other Parallels in two opposite places, should answer to two degrees in the same Circle. By which it appeares, that euery Meridian diuides the Terrene Globe in two halfes, whereof the one is respectiue ly tearmed of the East, the other of the West. But to auoid all ambiguity of speech, we ought to consider that a Meridian is twofold; either the true Meridian, or Magneticall Meridian. The true Meridian, ordinarily so called, is that which directly passeth by the Poles of the World; of which wee here treat, which indeed (as wee shall shew) is the onely true magneticall Meridian. But that which some haue falsly called the Magneticall Meridian, is that which runneth by the Poles of the Magneticall Variation, and much differs from the true; because (as we haue taught) the variation is diuerse according to the diuersity of places, & therefore cannot answer in any certaine proportion to the Poles of the Terrene Globe. The true Meridian Circle, as it hath manifold vse in Astronomy, namely to distinguish mid-day, and mid-night, to measure the rising and setting of the Starres, &c. matters not to bee neglected of Geographers; so hath it a more speciall vse in Geography: to designe the longitudes and latitudes of the places, with their distances, with many other matters treated of hereafter.

- 5 Concerning the Meridian circle wee are to know two things. The *Inuention* of it, and the *Distinction*: The *invention* is whereby wee are taught to find out the true Meridian in any place assigned.
- 6 The *Inuention* of the Meridian is againe two-fold: the one more Accurate, which is either Astronomicall or Magneticall, the other Popular; the Astronomicall way is performed by obseruing the celestiall motion.

The Meridian may bee found out the Astronomicall way in diuerse manners by Instruments deuised for this purpose by ingenious Artificers, whereof some are described by *Gemma Frisius* in his *Cosmographie*. But to auoid the cost of curious Instruments, I will set downe our way, depending on this Theoreme.

- I If two seuerall *Sunne-shadows* bee obserued, the one in the fore-noone, the other in the after-noone of the same day exactly to touch with their ends, the *Circumference* of the same circle described in a Plaine, Parallell to the plaine of the Horizon: The line from the Center equally diuiding the Arch of that Circle betwixt the two shadows, will bee the true Meridian circle for that place.

This Theoreme, howsoeuer consisting of many parts, is notwithstanding easie enough to bee vnderstood, being explainned by an ocular demonstration. Let there bee gotten a platforme of wood or metall, and placed euently that it may lye parallell with



with the plaine of the Horizon: In this plaine let there be described diuerſe circles from the ſame Center E. In this Center let there be rayſed a Gnomon EF to right angles; ſo that the top of this Gnomon F, ſhall euery where be equally diſtant from the circumference of each circle deſcribed in the plaine, which may eaſily be knowne, becauſe if it be equally diſtant from any three points of any circles Circumference, it will alſo be equally diſtant from all the reſt alike, as *Clavius* hath taught in the 4 of his *Gnomonicks*. This platforme being thus ordered let the ſhadow of the Gnomon be obſerued ſometimes before Noone, vntill ſuch time as it exactly ſhall touch the circumference of one of thoſe circles, as in EG. Again in the Afternoone, let the ſhadow be obſerued, till with his end it meet the circumference of the ſame circle, as in EH, which will happen ſo many houres afternoone, as the other before Noone. Theſe two points G and H, being diligently obſerued, let the Arch of the circle GH be diuided into two halſes with a
line

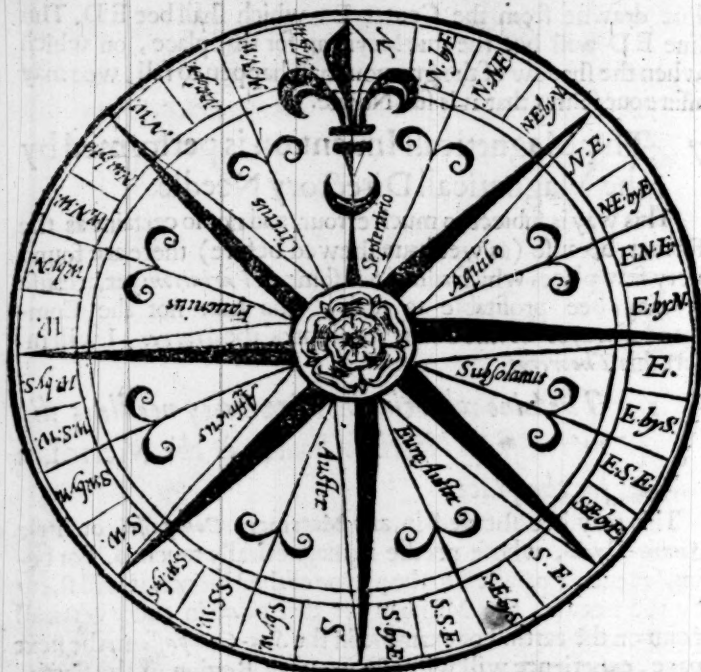
line drawne from the Center E, which shall bee E D. This line E D will bee the true Meridian for that place, on which when the shadow of the gnomon shall happen to fall, wee may assure our selues that it is full Noone.

7 The Magneticall Inuention is performed by the Magneticall Directory Needle.

This way is subiect to much errour, and not so certaine as the former, because (as wee haue shewed before) there are found very few places which admit not some of *Variation*: yet because it may bee profitable to such, who haue not the Command alwayes of the *Sunne*, or sight of the *Starres*, I will insert this *Theoreme*.

1 *The Line wherein the Directory needle is directed from North to South, is the Meridian for the place.*

This may bee shewed in any Marriners *Compass*, or *Sunne-Diall*, whose needle is magnetically touched. For being set euently parallell to the playne of the Horizon, it will shew by the needle, the Meridian for that place in euery verticall point on the earth. For example in the *Sea-Compass* in the next page, experience will witnesse in euery Region of the Earth, that the one point signed out by the *Lilly*, will alwayes turne to the *North*; the other opposite part, will turne it selfe to the *South*; which two parts being ioyned together by a right Line will shew the Meridian for that place: The Meridian (I say) not alwayes the true; for this Inuention taken from the *Magnet* is not so exact as the *Astronomical*: for as much as few or no places are found, wherein the *Magneticall Needle* admits not a *Variation* from the true points of *North* and *South*: Neuerthelesse, this way is very necessary to bee knowne: for as much as the *Sunne* and *Starres* are not alwayes to bee seene; at least in such place and manner as may fauour exactnesse of obseruation: Hence may bee demonstrated in particulars, what wee obserued before in generall in our *Magneticall*
I
Treatise,



Treatise that the *Circles* of the Globe are not meere *Imaginary Fictions*, or bare *Respects*, growing out of the Application of *Celestiall* bodies (as some haue thought them) but grounded on the *Magneticall* Disposition of the *Terrestriall* Globe.

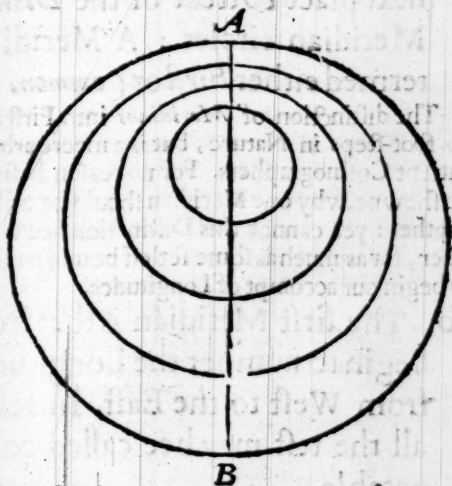
- 8 Beside the *Astronomicall* and *Magneticall* Invention of the Meridian, there is another way more popular, but lesse exact, which is without any obseruation of the Heauens, or the Magnets operation.

Of the Invention of the Meridian circle, the true and exact knowledge,

knowledge (as wee haue shewed) is endebted to heavenly obseruation, or Magneticall experiment. Neuerthelesse Nature is not so barren, but she hath pointed out to an industrious obseruation, some marks and foote-steps in other inferiour bodies, for the finding out of this profitable circle. Which wayes, how-focuer of lesse *Account* then the other, and therefore of lesse vse, are notwithstanding pleasant to vnderstand: because nothing delights more an ingenious minde, then the contemplation of Gods working, in and by his creatures, which men vsually terme *Nature*. To make a particular search into all Planets, Stones, Metals, and other such Bodies, were to goe too far out of my way, without a Guide. I will giue onc only Instance of Trees, whereof I will insert this Probleme.

1 *By the Incision of a Tree, to find out the Meridian.*

To performe this Probleme, let there bee chosen out some Tree in an open free field, farre from walles or other obstacles; in such a place as it hath beene on either side freely enlightened and heated by the Sunne-beames: let the Trunke of this Tree bee very right and sound: let this Trunke bee cut off by the middest, in such sort that the section be Parallell to the Horizon, and the vnder-part of the Trunke bee left to stand in his former Naturall situation: Now the Section on the top of it being well plained,



will as in a plaine discover diuerse circles, which are *Excentricke* and not drawne from the same Center, but on the one side neerer together, on the other further off: That part then which shewes the circles thicker and neerer together, points out the North: The other wherein the circles are wider and further off, the one from the other, designs out the South-point: betwixt both which if a right line bee drawne, it will bee the *Meridian* for that place. Which experiment *Blancanus* (as hee writes) tryed in a *Plume-Tree*, but giues no reason for it. The cause I take to be no other then the extension and diffusion of the sappe or moisture, by the heate of the Sunne: which is more on the *South-side* then the *North-side*: for as much as the *Sunne* in our clime respects vs on the South, neuer on the North. Hence is it, that the circles which are nothing else but the excrescences of the moisture, being more rarified on the *South-side*, and therefore requiring a greater place, are found to bee greater.

- 9 Hauing shewed the *Inuention*, wee are in the next place to treat of the *Distinction* of these *Meridian* circles: A *Meridian* therefore is termed either *First* or *Common*.

The distinction of *Meridians* into *First* and *Common*, hath no foot-steps in Nature, but is a meere arbitrary Imposition of antient Cosmographers. For no reason besides *Conueniency* can be shewne, why one *Meridian* should be called *First* rather then another: yet cannot this *Distinction* bee wanting to a *Geographer*, for as much as some settled bound must be set, from which to begin our account of *Longitudes*.

- 10 The first *Meridian* is that from which wee begin to number the *Longitude* of the Earth, from West to the East. In respect of which all the rest may bee called common or lesse notable.

The ancient Cosmographers, amongst whom *Ptolomy* was the chiefe, haue set the first Meridian in the *Fortunate* Islands, from whence they began their accompt, passing Eastward through *Europe* and *Africa*, and so through *Asia*, to the vttermost parts of *India*, vntill they returned againe to the first Meridian, passing through the *Fortunate* Islands; Some haue doubted whether these Islands called by *Ptolomy* the *Fortunate* Islands, be the same with the *Canaries*; because (as our Countreyman *M^r Hues* hath obserued) the Latitude giuen by *Ptolomy* to the *Fortunate* Islands, agrees not exactly to the *Canaries*; but rather to the Islands of *Cape-Verde*. Notwithstanding this obseruation, I rather sticke to the common opinion, thinking it no vnlike matter, that *Ptolomy* dwelling far Eastward, and trusting to other mens obseruations, should erre in this, as well as other matters. The reason why the first Meridian should bee placed here, rather then elsewhere, is thought by some to bee; because the Ancients supposed two *Magneticall* Poles in the Earth, which should bee the cause of the *Variation* of the *Compass*. Now because in the *Canary* Islands, was found no *Variation* at all, they thought it to bee the place where the *Magneticall* and the true Meridian should concur, as wherein were both the Poles, of the *World*, and of the *Load-stone*: which made them to make it the first Meridian: But this reason I take to bee vnlikely; because as I finde it obserued by latter Writers, in the *Canary* Islands themselves there is found a *Variation* of the *Compass*, although very little: the reason whereof wee haue shewed to bee because it is the middest betwixt two great Continents, to wit, the one of *Europe* and *Africa*, the other of *America*. Whose magneticall temper being almost equall, will not suffer the magneticall *Needle* to moue more one way then another: Moreouer, I am certainly perswaded (as far as I can gather) that this placing of the *First Meridian* was appointed here before any certainty was knowne of the *Variation* of the *Compass*. The more probable coniecture therefore is that *Ptolomy* here placed the *First Meridian*, because it was the vttermost verge of land toward the West, then discovered, neuer dreaming of a *Westerne* world afterward

detected and brought to light by *Christopher Columbus* and *Americus Vesputius*. Some of the latter *Geographers* striving to bee more exact, haue placed the *First Meridian* in their Mappes out of the *Canaries* in the Ilands of the *Azores* called *S. Michaels Island*. So that the first Meridian of *Ptolomy* differs from the place of these latter *Cosmographers* about 9 degrees: which is diligently to bee noted of such as beginne the Science; because this variety not perceiued, will breed great error and confusion: yet is not the first of *Ptolomy* out of vse, but retained of many good *Geographers*. Euery other *Meridian* in respect of this, may be called *Common*, or lesse notable, because this is most remarkable: yet may the rest compared amongst themselves be ranged in a certaine order, as the *Second, Third, Fourth, Fifth*, and so along till we come againe to the *First*, being in all reduced to the number of 180, answering to 360 Degrees as wee haue taught. So much for the *Meridians*.

II The *Parallels* are equidistant Circles passing from the East to the West directly.

I haue defined the *Parallell Circles* in a larger sense then former *Geographers* vsually haue taken it in: as willing vnder this generall name, not onely to include the *Parallels* commonly so called, but also the *Equatour*: because I see no reason why the *Equatour* being euery where equidistant from each other Circle, should not suffer this acception. The common sort of *Cosmographers*, vnder this name, would onely comprize the minor Circles, which are conceiued to bee equally distant and correspondent to the *Equinoctiall Circle*, so that all should bee so called in respect of the *Equatour*, to whom they are said to answer, not in *site* and *position*; for as much as they decline from the middle of the Earth to the North and South: but in *Comparison* and *Proportion*; for as the *Equatour* is drawne from East to West, and diuides the whole Spheare of the Earth into the North and South Hemispheres: So the other also diuide the Globe of the Earth, though not into two equall parts as the *Equatour*, but vnequall. These

Parallels.

Parallels many wayes are distinguished from the *Meridians*: first, because the *Meridians* are drawne directly from North to South: but the *Parallels* from East to West. Secondly, the *Meridians*, how many soever they are imagined to bee, concurre and meete all in the *Poles* of the Earth: whereas the *Parallels* howsoever drawne out at length, will neuer concurre or meete in any point. Whence it must needes follow that all *Parallels* and *Meridians* in the Globe must cut one the other, and make right angles. These *Parallels* although infinite in number, may bee in the *Sphere* reduced to the number of the *Meridians*, because they are drawne through the opposite points and degrees of the *Meridian Semi-circle*, which would make vp the number of 180: but yet for *Conueniency* they haue not painted so many in the face of the *Artificiall Sphere*; for as much as so many lines and circles might beget Confusion, Wherefore *Ptolomy* and the Ancients haue distinguished the *Parallels* on both sides the *Equator*, North and South, with such a Distance, that where the day should increase one quarter of an houre, a new *Parallell* should be placed. So that the longest day of one *Parallell* should surpassse the longest day of another, for one quarter of an houre. By which appeares that the *Parallels* are not of one greatnesse, but by how much neerer the Pole they are placed; so much lesse are they; and so much greater by how much farther off from the *Poles*, and neerest the *Equatour*. These Circles are of great vse in *Geographie*, as to distinguish the *Zone: Climats*, and *Latitudes of Regions*, to shew the *Elevation* of the Pole, and to designe out the *length* and *shortnesse* of the day in any part of the Earth.

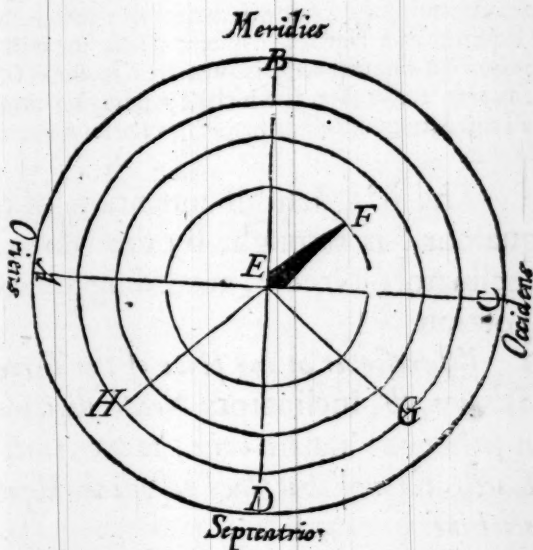
12 A *Parallell Circle* is of two sorts; either greater or lesser: The greater is the *Equatour* or *equinoctiall Circle*.

13 The *Equatour* is the greatest of the *Parallels*, passing through the middest of the Earth,

Earth, and exactly diuiding them from the Poles into two equall halfes or Hemisphæares whereof the one is North, the other South.

This Circle is called the *Equatour* or *Equinoctiall* of Astronomers; because, that when the Sunne passeth vnder it, as vpon the 11 of *March*, and the 13 of *September*, it makes the Day and Night equall. This Circle of Astronomers is esteemed the most notable, being the measure of the *Diurnall* and most regular Motions. The *Latines* haue taken the name and appellation of this Circle from the Day, as the *Greeks* from the Night: Wherein the Sense is no way varied; because the equality of the Day argues the like equality of the Night. The two Poles of the Circle, are the same with the Poles of the Vniuersall Earth: to wit, the Articke or North-Pole, and the Antarticke and Southerne Pole: whereof the former is alwayes conspicuous in our Horizon, the other lies couched and hidde from our Sight. It is called the *Articke-pole* from the Constellation of the little *Beare* in the Heauens, neere to the which it is situated: in opposition to the which the other is called *Antarticke*. It hath manifold vse in Astronomy, copiously by *Astronomers*: And no lesse in *Geography*: for without this *Equinoctiall* Circle, no Description of the Earth can be absolute & perfect, neither any Citie or Place. in the Terrestriall Globe or Mappe set in his due and proper place. This Equinoctiall Circle in regard of the Earth, passeth through the middle-most part almost of *Africa*, by *Ethiopia*, *America*, and *Taprobana*: So that it exactly diuideth the Globe of the Earth into two halfes, the *Northerne* and *Southerne* Hemisphæares; so that these people which dwell vnder the *Equatour* are said to inhabite the middle of the world, because they incline neither to the North, nor to the South: hauing so much distance from the *Articke Antarticke-Pole* of the Earth. Moreover, by this Circle (as wee will declare hereafter) are noted out vnto vs the East and West-part of the Spheare, no way to be neglected of Geographers.

- I Concerning the Equatour, two things are to be obserued: either the *Inuention*, or the *Site and Position*: The *Inuention* is either *Astronomicall* or *Magneticall*. The *Astronomicall* according to these Rules.
- I The *Meridian* being found out, to find the *Equator*.



This is easily performed by the helpe of the former Figure: for therein the Meridian line being found out (as we haue shewed) let there bee drawne by the Center E of that Circle, the line A C, making right Angles with the said Meridian: which line A C will bee the true Equatour, and will point out vnto vs the true *East* and *West*: as A the East and C the West. Whence it appears that the two lines, to wit, of the Equator

10m and the Meridian doe diuide and cut the whole Horizon into two equall Quadrants.

2 *Without the helpe of the Meridian to find out the Equatour.*

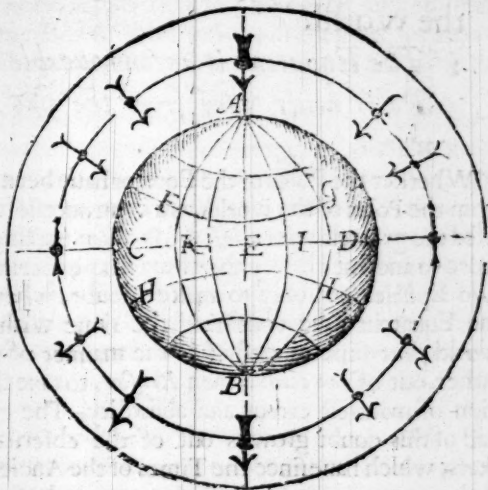
In the time of either Equinoctiall in some Horizontall plaine, in the Sunne-shine, let there bee crected a Gnomon: then in the day time, let there bee noted all the points by which the end or top of the shadow hath passed: for all those points in the time of *Equinoctiall*, are in a right line; because then the end of the shadow is carried in a line in the time of the Equinox in a Horizontall plaine: This line will bee the true *Equinoctiall*-line: the cause is giuen by *Clavius* in *Gnomonics*, lib. 1. prop. 1. *Corollar.* 2. which depending on many Geometricall and Astronomicall principles, as too far from my purpose, I omit.

15 The Magneticall inuention of the Equatour, is wrought by the Magneticall Inclinary Needle, according to this Proposition.

1 *Wheresoever at any place of the Terrestriall Spheare, the Inclinary Needle shall conforme it selfe in a Parallell-wise, to the Axell of the Earth, through that place passeth the Equinoctiall Line.*

As to finde out the *Meridian* of any place, wee are to vse the helpe of the *Director* Needle: so to the finding out of the Equatour, and Parallels, the Inclinary Needle is most necessary: because the former respects the Magneticall Motion of *Direction*, the latter of *Declination*: Now wheresoever wee shall see the Needle to conforme it selfe in such sort as it may lie Parallell with the *Axell* of the Earth, we may assure our selues that

that such a place is vnder the Equinoctiall Circle : The reason whereof, wee haue giuen in our 3 Chapter out of the *Conuerſible* nature of the Magnet, and here needs no repetition: only wee will infer this one figure where- in the line C D drawne through the Centers of two Inclina- tory Needles, lying Parallell



to the Axell of the Earth, A. B. will expresse this Equinoctiall line which wee here seeke. For the Magneticall *Inclina tory* Needle being set in a Frame or Ring made for such a purpose, will vnder the Equator respect one Pole no more then another: but lie leuell with the Plaine of the Horizon: as vnder the Poles it will make right Angles with the Plaine of the Horizon. In the middle spaces betwixt the Equatour and the Poles, it will conforme it selfe in such sort, as it makes certaine Angles with the Axell of the Earth, though not equall, yet proportionall to the Latitude; out of which an ingenious Artificer may deduce the Parallels of any place, without any obseruations of the Hea- uens: as is taught by Instruments inuented by *Gilbert*, *Ridley*, and diuers others which haue vndertaken this subiect.

- 16 Of the *Inuention* of the Equatour wee haue spoken: In the *ſite* we ought to con- sider

sider the placing of the Equator in respect of the world.

- 1 *The Equatour is an vnmoueable Circle, whose Poles neuer vary from the fixt Poles of the world.*

Whether the Poles of the Equator haue been any times varied from the Poles of the world, is a controuerſie which hath exerciſed the greateſt wits: *Ioſeph Scaliger* truſting (as it ſeemes) more to ancient Hiſtory then Moderne experiment, ſeemes in two Epittles not only to make a doubt, whether the Poles of the Equatour haue continued the ſame with the Poles of the world; but ſuperciliously (as the manner of moſt criticks is) rather out of *coniecture* then *Reason*, to taxe the common opinion of manifeſt error and abſurdity. The ground and originall of this doubt growes out of the obſeruation of the fixt Stars, which haue ſince the Times of the Ancients, bene found to bee moued out of their places, or at leaſt not to retaine the ſame points in the Period of the *Sunnes* Motion. The chiefeſt Inſtances are taken from the ſtars in the Hornes of *Aries*, which in *Hyparchus* time, which liued about 60 yeeres before *Ptolomy*, were obſerued to bee not much diſtant from the *Equinoxe*, and before him in the very point it ſelfe; but in our time remoued about 28 Degrees off: Alſo it is obſerued in the Cynofure or Pole-ſtar, that in *Hyparchus* time it was diſtant from the Pole about 12 Degrees, which wee finde in our time to bee ſcarce 3 Degrees diſtant. To ſalue this Apparence, *Ptolomy* inuented a ſlow motion of the *Starry* Heauen or *Firmament*, whereby the Fixt ſtars might bee remoued farther off from the Equinoſtiall points in the *Eclipticke*, whence of a conſequence the *Pole-ſtarre* ſhould not keep the ſame poſition in reſpect of the *Pole* it ſelfe, but vary his ſite according to the Motion: which opinion hath a long time paſſed without contradiction; till *Copernicus* out of new grounds ſought for this Motion in the Earth, to which hee assigned no leſſe then three Motions. Since *Copernicus*, aroſe *Ioſeph Scaliger*, who
con-

contradicting the common received grounds, and yet for ought I see, not trusting to the suppositions of *Copernicus*, would bring in another opinion: to wit, that the Stars of the Firmament are not moued from the point of the *Equinoxe*, but rather that the point is carryed away from the stars. The decision of this point I dare not undertake, better becomming the learned and industrious endeauours of our worthy Professours, M. Doctour *Bainbrigge*, and M. *Henry Briggs*, as best suiting with their Learning and Profession: *Ipse semipaganus, ad sacra vatam carmen offero nostrum*. Neuerthelesse as a Learner, for mine owne satisfaction, I would willingly enter a little into conference with this great and admired Oracle *Ioseph Scaliger*, to sound the certainty of his grounds. That the *Pole-starre* (saith hee) was so far distant from the *Pole* as 12 Degrees, was no true obseruation, but the error of *Hyparchus*, who afterwards by his authority deceiued *Ptolomy*; and He, Posterity. The Reasons hee allcaded are, 1 Because *Endoxus* which was more ancient then *Hyparchus*, obserued the same star to bee in no other place, then where now it is. 2 Because that greater light of Astronomy, *Copernicus* perceiuing the *Equinoxes* and *Solstitiall* points to be moued, was enforced to inuent other grounds; but because his demonstrations depended only on the *Apparences*, hee sought out this effect in the motion of the Earth. If it were manners to oppose so great a Scholler as *Ioseph Scaliger*, I would aske a few questions, why we should not credite the obseruations of *Hyparchus*, *Ptolomy*, and all posterity, as well as of *Endoxus*: sith Antiquity without consent & approbation, is no great argument of truth. Neuerthelesse if the matter be well examined, we shall perhaps find Antiquity to be more firme on our side. The same reason (as I take it) may be giuen for the stars in the Hornes of *Aries*, as of the *Pole-starre*, because all the *fixt-stars*, by the consent of all, are imagined to keep the same vniforme site among themselves in such sort, as the varying of some would disorder all the rest: at least argue the like variety or change of all. Now to proue the stars of *Aries* to haue beene varied, many of the Ancients (as Master *Hues* hath obserued) living in diuers times, haue confirmed. The first star of *Aries*, which in the time of *Meto Atticus*,

was

was obserued in the *Vernall Interfection*, in the time of *Thales Milesius* was before it 2 Degrees; in *Tymocharis* age it was after it 2 Degrees 24 Minutes: In *Hipparchus* time 4 Degrees, 40 Minutes; in *Abbumazars* 17 Degrees, 50 Minutes; in *Albarrens* 18 Degrees, 10 Minutes; in *Arzachels* 19 Deg. 37 Min. in *Alphonsus* his time 23 Deg. 48 Min. In the time of *Copernicus*, and *Rheticus*, 27 Degrees, 21. Min. In our time about 28. Against all these Testimonies, if we should oppose the Testimony of *Endoxus* and *Scaliger*, wee should bee thought very partiall to preferre them before the consent of Antiquity: *Endoxus* though very *Antient*, being but one, and the other one of the last. If any should object, that *Endoxus* spake onely of the *Pole-starre*, and not of the stars, in the horns of *Aries*; I answered, as before, that the same reason is to bee giuen of them both; For as much, as if the *Pole-starre* in *Endoxus* time moued in a Parallell, Equidistant from the *Pole* of the Equatour (which he seemes to contend) then must also the stars of *Aries*, which were found once to bee in the point of the vernall Equinoxe, moue alwayes in the Equinoctiall circle, and neuer vary from it; which is contrary to all the Testimonies before alleadged. Secondly, where he saith, that *Copernicus* perceiuing this error, left a base discouery, without any *Demonstration*, except onely *Ἐκ τῶν παλαιότητων*, I would know how *Ioseph Scaliger* by any other meanes came to know it? I alwayes supposed it a principle amongst *Mathematicians*, that the *τὰ παλαιότερα* had bene the surest ground of Mathematicall Demonstration: for euery reason which can be alleadged, must of necessity bee grounded on meere coniecture, as forged in a mans braine without any obseruation of Nature; or else suggested vnto vs from the things themselues. How little dependency is on the *Former*, let euery man iudge: where it is as easie for euery man to deny, as affirme; and such fancies are better reserued in the braine, wherein they were first hatched, then bee suffered to proceed further. If wee deriue our Argument (as we ought to doe) from the footsteppes of Nature; wee must draw it either from the *Forme* it selfe, or from some *effect* or propriety arising from it: The former is vnpossible I may well say in any thing,

thing; because the first *forme* and nature, no wayes discovers it selfe to our vnderstanding, but by the apparent Accidents: much lesse can this bee hoped for in the Heauens, being as far distant from vs in space, as Nature. If then we are left only to the later, what other ground can we haue of our Argumentation, then the *τὰ φαινόμενα* or Apparences: which kind of way, *Scaliger* in *Copernicus* striues to sleight or reiect as weake or deficient: taking then this to bee the onely way to search as neere as wee can into the truth of their matters, wee will in the third place shew how far it may oppose *Scaliger*, and fauour our Assertion. That the first Star of *Aries* is more distant from the Equinoctiall point, is a matter which seemes to bee agreed on by all sides. This Apparence must necessarily arise out of some Motion. This Motion must bee sought either in the *Earth* (as *Copernicus* would haue:) or in the *Heauens*. That it cannot with any great probability bee in the *Earth*, wee haue shewed in the third Chapter, where wee haue proued it to haue a Magneticall verticity, whereby it continually respects the same *Poles*. The Arguments (I confesse) are only probable: but this is an opinion which *Scaliger* defendeth not. If wee seeke this effect in the Heauens, it must of necessity (which *Scaliger* confesseth) happen one of these 2 wayes: For either the stars standing vnmoueable, the Equinoctiall & Solstitiall points must bee moued, or els the stars themselues should moue, as *Ptolomy* defends. Here I cannot but remember a merry answer of that great *Atlas* of Arts, Sir *Henry Sauike* in the like question. Being once inuited vnto his Table, and hauing entred into some familiar discourses concerning *Astronomicall* suppositions: I asked him what he thought of the *Hypothesis* of *Copernicus*, who held the *Sunne* to stand fixt, and the *Earth* to bee subiect to a *Triple* Motion: His answer was; hee cared not which were true, so the Apparences were solued, and the accompt exact: sith each way either the old of *Ptolomy*, or the new of *Copernicus*, would indifferently serue an Astronomer: Is it not all one (saith he) sitting at Dinner, whether my Table be brought to mee, or I goe to my Table, so I eat my meat? Such an answer would aswell besit this question: whether the first star of *Aries* should bee moued from the Equinoctiall

quinotiall point, or the *point* from it, 'tis a matter should little trouble a *Cosmographer*; so either way might indifferently serue to salue the apparent obseruations: But how *Scaliger* vpon this granted supposition, would make all whole, without disturbing the order and forme of Nature in the celestiall Machine? what Regular motion he would giue the Sunne, whose period describes the *Equinotiall points*, which he makes moueable? what other *Poles* he would assigne to the world besides that of the Equator? is a matter of a more curious search, and besides the limits of my subiect: The full discussion of which points, as most of the rest: *Illis relinquo quorum imagines lambunt---Hedera sequaces.*

17 The *lesser* Parallels are equidistant lines answering to the Equator, which diuide the Globe of the Earth into two vnequall parts.

18 These *lesser* Parallels are againe of two sorts: either *Named* or *Namelesse*; *Named* are such as are called by speciall names, and haue more speciall vse in Geographie; such as are the two *Tropicks*, and the two *Polar* circles.

19 The *Tropicks* are Parallels bounding the Suns greatest declination, which is either to the North, and is called the Tropicke of *Cancer*: or towards the South, and is called the Tropicke of *Capricorne*.

The Tropicke haue taken their names from the conuerſion or turning backe of the Sunne; becauſe the Sunne declining from the *Equinotiall* circle either North or South, proceedeth in his course no further then this circle, and ſo turneth backe: ſo
that

that in the heauens they are as limits and bounds, comprehending within them that space, without the which the Sunne neuer moues: Consonant to these *Celestiall Tropicks*, are there imagined in the earth the like, immediately placed vnder them: which are apparent, not onely by *Application* of the *Celestiall Globe*, and his parts to the *Terrestrial*; but also out of the *Magneticall* disposition of the earth, as wee haue already shewed: The Tropicke bounding the Suns greatest declination towards the North, is called the Tropicke of *Cancer*; because the Sunne arriuing at that Tropicke, is lodged in the signe of *Cancer*: The other is termed the Tropicke of *Capricorne*; because the Sunne touching that Tropicke, is in that signe: The distance of these Tropickes, from the Equatour, is ordinarily put 23 Degrees, and 30 Minutes; which is also the distance of the Poles of the *Eclipticke*, from the Poles of the world. The Tropick of *Cancer*, as it is conceiued in the Earth; passeth by the greater *Asia*, by the *Red-Sea*, or *Sinus Arabicus*, and *China*, and *India*: But the Tropicke of *Capricorne*, situate on the Southerne side, runneth along by the most Southerne coast of *Africke*, and that part of *America* which is called *Braglia*; Besides many Ilands in the *Indian Sea*.

- 2 The *Polar* circles are Parallels answering to the *Polar* circles of the Heauens, drawne by the Poles of the *Eclipticke*: These are of two sorts: either the *Articke* compassing round the North-Pole; or the *Antarticke* compassing round the Antarticke or South Pole.

The *Polar* Circles, as they are conceiued in the heauens by Astronomers, are described by the Poles of the *Eclipticke*, carried by the diurnall motion about the Poles of the world. Correspondent to these circles in the heauens are imagined two circles on the earth, which wee also call *Polar*; and if wee

beleeue *Gilbert*, with other Magneticall Philosophers, they are primarily in the Earth, as that which is the true subiect of diurnall motion. These circles thus described by the Pole of the Eclipticke, must needs challenge the same distance from the Pole, which the Pole of the Eclipticke hath, to wit, 23. Degrees, and 30 Minutes. The *Greeks* haue taken the Polar circles, in another sence then the *Latines*: for by these Polar circles (as it appeares by *Proclus*, and *Cleomedes*) they vnderstand not such circles as are described by the Pole of the *Zodiacke*: but two other circles; whereof the one is greatest of all the *Parallels*, which alwayes appeares about our Horizon; the other is the greatest of all those *Parallels*, which lie hid in our Horizon perpetually: The reason why the *Gracians* tooke it in this sence, was; because by these circles they could know and distinguish those stars; which alwayes are seene and neuer set, as those which are comprehended of the *Articke* circle; from those which alwayes lie hidde and neuer rise; as such as the *Antarcticke* containes: Whence it manifestly appeares, that the two Polar circles, as they are taken of the *Gracians* in all Regions, are not of the same quantity & greatnesse, but are greater in oblique Spheare then in a right: but our Polar circles are at all places alike in their quantity. Of these, the one tearmed *Articke* in the Earth passeth by *Islandia*, the top of *Norway* and *Finland*, with many adioyning Ilands, and the Southern part of *Green-land*, as may appeare by our ordinary Geographickall Mappes. The other Polar circle called *Antarcticke*, passeth through the South part of the world (as yet) vndiscovered, except for some few parcels, as *Terra del Feugo*, and *Psitacorum Regio*, with somewhat more, lately discovered by the *Spaniards*. The chiefeft vse as well of these, as other parallels, is to distinguish the *Zones* and *Climates* in the Globe, whereof wee shall haue occasion to treat hereafter.

21. The Namelesse *Parallels* are such as are not knowne by speciall Names, nor of so great vse in Geographie.

These

These namelesse parallels may bee well vnderstood by that which we haue aboue spoken: for howsoeuer they bee not called by particular and speciall names, yet are they all of the same nature: All these parallels beside the Equatour, though infinite in number, may notwithstanding in the sphere be reduced to the number of the Meridians; because they are drawne through the opposite points of the Meridian semicircle; so that wee might account 180: but yet there are not so many painted on the face of the *Artificiall* Globe; wherefore *Ptolomy* with the ancients, haue distinguished the parallels on both sides, North and South, beginning from the Equatour at such a distance, that where the day should increase one quarter of an houre, a new parallell should be placed: so that the longest day of one parallell, should exceed the longest day of another parallell by one quarter of an houre. Euery one of these parallels, is supposed to be diuided into 360 Degrees, as all the rest of the other circles; yet are we to note that the degrees and parts of a greater circle are greater; of the lesser, lesse, according to the proportion of the said circle; the same haue the proportion that a great circle hath to a lesse, so that the same degrees and parts of a quarter circle, to the degrees and parts of the lesser; as may be gathered from the first proposition of the second booke of *Theodosius*: now to know rightly this proportion, we must first finde out the summary declination for euery region, which being once found, we may proceed in this manner, by the doctrine of Triangles.

I Let the signe of the Complement of the Declination of the lesser Circle bee multiplied by the whole Circle, and the product bee diuided by the totall signe, there will arise the number of Degrees of the lesser Circle, such as whereof the greater consists.

The reason hereof is shewed in Geometry, and therefore need we not to insert a demonstration; for there we learne, that

as the totall sine is to the signe of the Cōplement of the Declination of any Parallell, so is the Periphery of the greater circle, to the Periphery of the Parallell: As for example, if we would know what proportion the Equatour hath to the Parallell, which passeth by the Verticall point of *Rome*; whose Declination is about 42 Degrees; I multiply the signe of the Complement of this Declination, that is, the signe of 48 Degrees, to wit, 74314, by 360; the product whereof is, 26753040; which I diuide agayne by 100000, and find 267 degrees, and $\frac{1}{2}$: whence I gather that the Equatour to the Parallell of *Rome*, or a degree of the Equatour, to a degree of the Parallell of *Rome*, hath the same proportion that that 360 hath to 276 $\frac{1}{2}$, which is the same that 4 hath to 3.

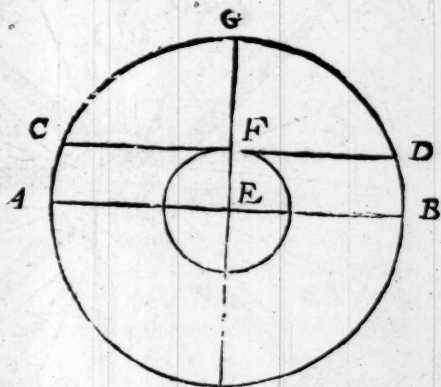
22 Hitherto haue we spoken of the *Absolute* Circles, such as are the Meridians and Parallels: wee are to treat in the last place of a *Relative* Circle, which is conceiued in respect to our sight: this Circle is called the *Horizon*.

23 The *Horizon* is a Circle which diuides the vpper and visible parts of the Terrestrial Globe, from the lower and inuisible.

The name of the *Horizon* is taken from the bounding or termination of the sight; because it is a Circle comprehending all that space which is visible of vs, distinguishing it from the rest which lurkes inuisible: as if a man should bee placed in a high and eminent place of the Earth, and should looke round about him euery way to the *East, West, North, and South*; Hee will seeme to see the heauens on euery side to concur with the earth: so that beyond it, can be seene nor beauen nor earth: which concurrence of the heauens with the earth, will describe unto vs the *Horizontal Circle* for that place assigned. But
here

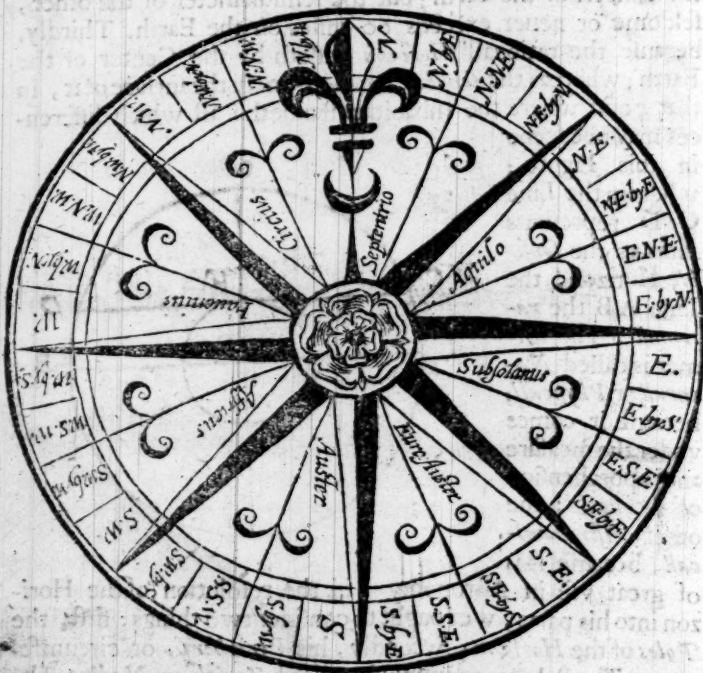
here wee are to note, that the Horizon is two fold; either the *Rationall* or *Sensible* Horizon. The *Rationall* precisely diuides the Globe into two equall parts: But the sensible or apparent Horizon, is no other then that Circle in the earth, which is designed out by the sight, from which the name seemes to bee deriued. This sensible Horizon differs from the rationall diuers wayes; first, because the *rationall* diuides the whole spheare into two equall parts; but the *sensible* into two vnequall parts. Secondly, because the rationall is alwayes certaine and the same, in the same place, and of alike greatnesse; whereas the other is greater or lesser, for the condition of the place or sight; for the semidiameter of the rationall, is the same with the semidiameter of the earth; but the semidiameter of the other, seldome or neuer exceeds 60 miles on the Earth. Thirdly, because the rationall *Horizon* passeth by the Center of the Earth; whereas the *sensible* toucheth onely the surface of it, in that point where the Inhabitant standeth: all which differences may bee seene

in this Figure; wherein the Line C D represents vnto vs the *sensible* Horizon: the Line A B the *rationall*: The former is called *Naturall* or *Physicall*; because it comes vnder the measure and apprehension of the sense: the other *Astronomical*, because it is



of great vse in Astronomy: in the resolution of the Horizon into his parts, wee ought to consider two things: first, the *Poles* of the *Horizon*; Secondly, his *Periphery*, or circumference: The *Poles* are commonly called *Zenith* or *Nadir*: The

Zenith is the *Verticall* point, directly placed ouer our Head: whereunto is opposite on the other side, the *Nadir* directly vnder our foote, and therefore may bee called the *Pedall* point. The parts or interfections in the circumferences, are designed out vnto vs, by certaine lines, discovering the coasts in the Terrestriall Globe: These lines are called either *windes* or *Rhumbes*: The windes with the *Grecians* were onely 8. But the latter Navigators haue increased them to the number of 32, whereof foure were called *Cardinall*, to wit, such as are directed to the foure coastes of *East*, *West*, *North*, and *South*: The other are *Collaterall*, being placed on each side of the *Cardinall* windes. The *Rhumbes* are Lines passing by the Verti-



call point of any place, as you may see in the *Compass* going before: Now because one *Rhumbe* answers to two coasts or windes; the number of the *Rhumbes* is but halfe the number of the windes; to wit, 16. Here it is to bee noted, that a *Rhumbe* differs from a *Winde*; whereas a *Rhumber* is one line, pointing out vnto vs, two windes or coasts: These *Rhumbes* as they are conceiued in the *Globe*, were thought by *Nonnus* to bee the portions of greater Circles: But learned Mr *Hues* in his booke, out of vndoubted principles, strongly confutes him. The grounds which hee takes are these: First, that all *Meridians* of all places passe the Pole, and cut the *Equatour* and all his parallels at right Angles. Secondly, If our course should bee directly any way else, then towards one of the poles, a new *Meridian* must succeed, and a new *Horizon*. Thirdly, that the *Iron Needle* being touched with the *Load-stone*, shewes the common section of the *Meridian* and the *Horizon*, and on one side perpetually respects the *North*, on the other the *South*. Fourthly, the same *Rhumbe* cuts all the *Meridians* at all places at equall Angles, and euery where respects the like coasts in the world. Fifthly, that a greater circle drawne by the *Verticall* points (if remoued from the *Equatour*) cannot cut diuers *Meridians* at equall Angles. Sixthly, a greater circle drawne by the *Verticall* point of any place, makes greater Angles with all other *Meridians* then with that, from which it was first drawne: whence it is necessary, that the line which shall bee supposed to make Angles with diuers *Meridians* (as the *Rhumbes*) should bee bowed toward the *Meridian*. I know not what would bee more said against the opinion of *P. Nonnus*, who would haue all the *Rhumbes* to bee portions of greater circles. To illustrate further the nature and vse of the *Horizon* wee will insert these Theoremes.

- 2 *The Sensible and Rationall Horizon in the Earth, are much different; in respect of the Firmament, all one.*

Ptol. dist. 1.
cap. 5.
Alph. 6.
diff. 6.

Prop. II.
lib. 1.

* *Pag. 149.*

It may bee gathered out of the suppositions of *Ptolomy* and *Alphraganus*, and almost all other Astronomers, that no man being placed on the surface of the earth can precisely see the halfe of it. For that Horizon which terminates our sight, as we haue shewed, is a plaine superficies euery way circularly extended in the Earth, in such sort as men placed, either in the Sea in a ship, or in a great field or Countrey, would thinke the visible part of the earth to bee plaine, whose ends would seeme to touch the Heauens. Whence must needs come to passe that such an Horizon cannot diuide the Spheare of the earth into two equall parts. For so much will be found wanting, as is measured betwixt that superficies which toucheth the earth, and that which passeth by the Center of it, equidistant from the other: for this later only can diuide the earth into 2 equall parts, according to *Theodosius*, and may well bee seene in the * former figure, wherein are expressed both *Horizons*, as well the visible as inuisible, touching the Spheare in a point on the superficies: as the *Rationall* passing by the Center. Neuerthelesse wee must consider, that the quantity intercepted betwixt these two *Horizons* in the Terrestrial Spheare, is of little or no moment, compared with the whole frame of the Heauens: For sith the Heauens are so farre distant from vs, it will come to passe that if two equidistant lines should bee drawne, the one from the *Eye*, the other from the *Center* of the Earth to the *Firmament*, they would according to sense, appeare one and the selfe-same; by reason of the wonderfull distance: as wee see in a long Gallery, whose walls haue an equall distance the one from the other; the walls will notwithstanding (according to *Opticall* principles) seeme widest where they are nearest, and to close and shut vp at the ends, or at least to concurre neerer: much more must wee imagine this to happen in the sight, if we compare the greatnesse of the *Firmament* with the Spheare of the Earth, in whose magnitudes wee shall finde a incomparable disparity. This will appeare by the Apparences: for wee shall see the six signes of the *Zodiacke*, conspicuous aboue our *Horizon*, and the other six vnder it, hid from our sight: Also the *Sunne* and *Moone*, when they are diametrally

trally opposed, almost at the same moment will appeare, the one in the East, the other in the West: at least the one will rise soone vpon the setting of the other: And (if we beleeeue *Pliny*) the Moone was obserued to bee eclipsed in the East point; the Sunne at the same time being in a sort about the Horizon in the West. Such an Eclipse could not happen without a diametrical opposition of the two lights, and therefore can the Sensible and the Rationall Horizon haue no sensible difference in respect of the Firmament.

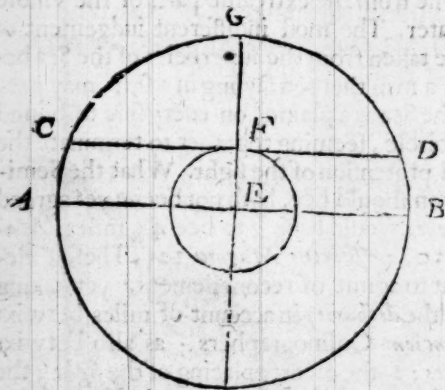
2. *The sensible Horizon may be greater or lesser according to the nature and disposition of the place.*

In this consideration wee take no notice of the difference of sights, whether they be weaker or sharper; but suppose an eye sufficient to kenne so farre in the Earth, as the place will permit: The difference then betwixt diuerse Horizons must be sought out in the condition of the place. A *Sight* placed on the top of a high mountaine, may see much farther then one in a low valley, compassed about with hills; for as much as the Semidiameter of the sensible *Horizon*, which is equall to the Rayes or Lines drawne from the extreame parts of the visible Earth, are much greater. The most indifferent iudgement of this *Horizon*, may bee taken from the superficies of the Sea beyond sight of land: for a man thereon sayling in a ship, may perceae the surface of the Sea as a plaine, on euery side to bound the sight in a round circle, seeming together to terminate the end of the Earth, and protension of the sight. What the Semidiameter of this *Horizon* should bee, hath not beene yet agreed vpon by all: *Erasthenes* would haue it to bee 44 miles, *Macrobinus* 23. *Proclus* 250. *Albertus Magnus* 125. These differences seeme too great to admit of reconciliation: yet taking into our consideration the disparity in account of miles betwixt the *Moderne* and *Ancient* Cosmographers; as also betwixt the *Greekes* and *Latines*: 2 the diuerse placing of the sight; the various disposition of the places wherein they tooke their obseruations, with other circumstances, wee should diminish much

of admiration. But diuerſe others whoſe opinion is more approved by moderne Coſmographers, haue defined it to be about 63 miles. The cauſe why this Horizon ſhould bee ſo little in reſpect of the Rationall which paſſeth by the Center, is the roundneſſe of the earth interpoſed betwixt the ſight and the farther parts, which we haue formerly proued.

3 *The eye may be ſo placed on the Earth, as it may behold the whole Hemisphære of the heauens, and yet no part of the Terreſtriall Spheare.*

This may ſeeme a paradoxe with vulgar iudgement; but it wants not a demonſtration drawne from Aſtronomically and Opticke principles. To expaine which, we muſt ſuppoſe out of the grounds already granted, 1 That the *Senſible* and *Rationall Horizon* in reſpect of the Heauens, ought to bee eſteemed one and the ſelfe ſame, by reaſon of the great diſtance and diſproportion betwixt the Earth and the Firmament. 2 That the eye of the beholder is in this ſort ſuppoſed to bee in the Center; becauſe in this conſideration the diſtance betwixt the ſuperficiſ of the Earth, and her Center, is inſenſible. 3 That the viſuall Ray wherein the ſight is carried, is alwayes a right line. Now



ſuppoſe (according to our former figure) the Center of the eye wherein conſiſts the ſight, to be in the point of the Terreſtriall ſurface F, the diſtance (as we ſaid) betwixt F and E the Center being inſenſible, the eye is imagined in the center:

likewiſe the Horizons C F D, and A E B for the ſame cauſe in

in respect of the Heavens are to be esteemed one and the same; because CA and DB have no sensible difference. It is then manifest, that the eye so placed will behold in the heavenly Spheare, all which is included betwixt A and B, to wit, the Hemisphære A G B, bounded by the Rationall Horizon A E B. Neuerthelesse in the Terrene Globe it can see nothing at all: For either it should see onely the point F, wherein it is seated, or else some other point or part distant from it: the former cannot be admitted, because the eye being there supposed to be placed, should according to this supposition behold it selfe, which is against philosophy: For granting the sense only a direct and not a reflexe operation, it cannot be imagined how it should perceiue it selfe. Finally, it cannot see any point in the Earth besides; for then this point would either be placed about the point F: but this cannot be; because F being supposed in the superficies, admits of no point higher in the Spheare, or else vnder it: but this cannot be, because C F D being a tangent line, and touching the Spheare in F only: there cannot according to Geometrical principles be drawne any right line from the point F, which can touch any point in the said Spheare, but all will cut it, and so the section cause impediment to the sight, the Earth being an opacous and round body.

4 *From the Horizontall circle is reckoned the elevation of the Pole in any place assigned.*

The finding out of the elevation of the Pole is a matter most necessary for a Cosmographer; as shall appeare after, where we shall speake of the *Latitudes* and *Climates*. It is defined to be an arch of the *Meridian* betwixt the *Horizon* and the Pole. For the finding out of which many wayes haue beene deuised by Artificers: The first is taken from the Sunne, the second from the Pole-starre: From the Sun it may be performed two wayes. 1. At the time of the *Equinoxe*. 2. At any other time of the yeere. At the time of the *Equinoxe* it may be found out by the obseruation of the Sunnes shadow at Noone-tide, in this manner: Let the Meridian height of the Sunne be subtracted

tracted from the whole quadrant, which is 90 degrees: there will remaine the distance of the Zenith to the Equator, which is equall to the eleuation of the Pole. In the second place at any time of the yeere to know the eleuation of the Pole out of the Meridian height of the Sunne, it is necessary out of an *Ephemerides*, or any other way, accurately to finde out the place of the Sunne in his *Eclipticke* for the day proposed, together with his declination: for the declination of the Sunne, the Sunne being in the six Northerne signes, subtracted from the Meridian altitude; or added, the Sunne being in the six Southerne signes, will precisely giue the height of the Equator: or (which is the same) the *Meridian* height of the *Sun* in the *Equinoctiall*: which being once found, we may worke as in the former. By the Pole-starre wee may likewise find it out, if wee obserue it three distinct times in the same night: for three points being giuen, euery Geometrician will finde out the Center, which in this case must bee the Pole. Many other wayes haue beene inuented by skilfull Astronomers, which appertaining rather to *Astronomy* then *Cosmography*. I purposely omit.

24 Concerning the Horizon, two things are chiefly to bee noted, the *Inuention* and the *Distinction*. The Inuention is considered either as it concerne the Zenith or Pole: or the Plaine of the Horizon. For both which we will set downe these Rules.

- 1 *The height of the Pole subtracted from the quadrant of 90 Degrees: the residue will shew the Zenith or distance of the Zenith from the Pole.*

The reason is euident; because the height of the Pole, together with the distance of the Pole and the Zenith make an arch, which is a whole quadrant: so that the height of the Pole subtracted, the distance will remaine; as for example, if wee put the eleuation

elevation of the Pole here in *Oxford*, to be $51\frac{1}{2}$ degrees or thereabout (as hath been formerly taught : Let these $51\frac{1}{2}$ degrees bee subtracted from 90, then will remaine $38\frac{1}{2}$, which is the true Zenith for that place.

- 2 *A line which makes right angles with a plummet perpendicularly falling on it, will designe the Horizontall plaine.*

The practise of the proposition is vsually shewed by Artificers by a certaine instrument called a *Level*, which is made in a triangle forme : from the vertex, or head of which, a line with a plummet falls on the Basis. Now when it shall bee found to be so placed, that the line and plummet falling on the Basis, shall make right Angles with it, and cut the whole Triangle into two equall halves : wee may account the Base-line to bee the plaine of the Horizon : For of this plaine, such is the position, that it inclines no more on the one side then on the other, but lies euē : as wee see in the surface of the water, when it rests quiet without motion : for howsoeuer the water so resting (as we haue formerly demonstrated) is alwayes sphericall, yet in a small distance in the sensible Horizon, it may to sense be represented by a plaine.

- 25 So much for the Invention : The Distinction of the Horizon is into three sorts : for either it is a right Horizon, or oblique, or parallell.

- 26 A right Horizon is that which with the Equator makes Right Angles.

This distinction growes naturally out of the Respect of the Horizon to the Equatour. For sith the Equatour is one and the selfe-same immoucable circle ; and the Horizon is mutable and changed according to his diuerse verticall points, they cannot alwayes keepe the same situation in regard one of the other. This they haue reduced into three heads : for either it is *Right*

or *Oblique*, or *Parallell*. The Right is so called from the right Angles which the Horizon makes with the Equator: wherein the two poles are alwayes couched in the Horizon, and the E-



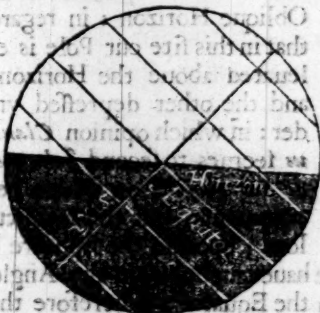
quator passing directly ouer their heads, as is plaine to be seene in this figure here affixed: such an Horizon haue these Inhabitants which dwell directly vnder the Equinoctiall line, in the very middest of the Torrid Zone: such an Horizon agrees to a great part of *Affricke*: to a part of *Peru* in *America*.

Also to most of the *Molucco* Ilands, the Ilands of *Taprobana*, and *S. Thomas*: but no part of *Europe* is subiect to such a Right Horizon. The cause of this variation of Horizons is the naturall roundnesse of the Earth: For the earth being supposed to bee sphericall, as we haue before demonstrated, it must of necessity follow, that the site of the poles should be changed according to the diuersity of the places. Also, because wheresoeuer we are placed on the Earth (as wee haue shewed) all impediments of the sight, as mountaines and vallies put apart, we can behold the Hemisphere of the Heauens, which middle part being set downe is diuided from the part vnseene, by the Horizon it must needs bee, that either both the poles must be in the Horizon: and so make a Right Spheare: or at least one must bee aboue and seene, and the other hid from the sight, and so much as one is eleuated aboue the Horizon, must the other bee couched vnder it. For otherwise wee should see more or lesse then a precise moiety, or halfe of the Heauens: sith the poles differ one from the other the halfe of the whole Heauens: to wit, by the Diameter of the world.

27 An oblique Horizon is that which with the Equator makes oblique Angles.

Those Inhabitants are said to haue an oblique Horizon, whose site

site and position declines somewhat from the Equator, either to the North or South towards either pole: yet so that the pole bee not eleuated so high as 90 Degrees: for then it becomes a *Parallell Horizon*, as wee shall shew in the next. The representation of such an oblique Spheare may bee seene in this Diagram: wherein the Horizon cuts the Equatour at oblique Angles, whence it is called *oblique*.

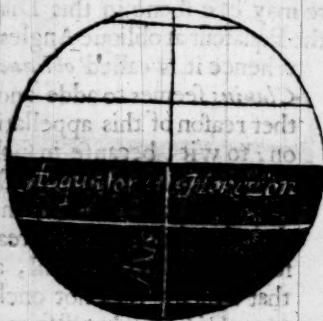


Clauius seemes to adde another reason of this appellation: to wit, because in such an Horizon one pole is alwayes eleuated above, and the other hid: but this reason seemes too generall, as that which agrees not onely to an *Oblique*, but also to a *Parallell Spheare*. From this Horizon, by *Johannes de Sacrobosco*, the Spheare is called *Artificiell*: because, as *Clauius* conjectures, it is variable, and doth naturally divide the Globe. For whereas the Horizon of the Right Spheare passeth by either Pole, it seemes by it selfe (as it were) Naturally and Directly to divide the Spheare: and this diuision is no way variable, as that it should bee more or lesse Right: but contrariwise in the oblique Spheare, sith one Pole is placed above, and the other beneath, it seemes to be placed out of his naturall site and position. Moreover this Oblique Horizon is variable according to the diuersity of habitations, so that it may be to some more, to others lesse Oblique: for so much the more Oblique must it be, by how much the neerer it is placed to the Poles. The Inhabitants of an Oblique Spheare are such as seated betwixt the Equator, and either of the Tropicks of *Cancer* and *Capricorne*, or such as dwell betwixt either Tropicke and the Polar-circle.

28. A *Parallell Horizon* is that which lies *Parallell* to the Equator, making no angles at all with it.

Such

Such a kinde of Horizon those Inhabitants are said to haue, which are included betwixt the Poles of the world, and the Polar circles; whose Horizon cuts not the Equatour at any Angles at all, either Right or Oblique: but lies Parallell vnto it, as



we see in this Figure here set downe. Some haue reduced this kinde of Spheare to an Oblique Horizon: in regard that in this site our Pole is elevated aboue the Horizon, and the other depressed vnder: in which opinion *Clavius* seemes to second *Johannes de Sacrobosco*, on whom hee comments. But this is ridiculous; because the Spheare is

called *Right* or *Oblique* (as wee haue taught) from the Angles which the Horizon makes with the Equator: wherefore that Horizon which makes no Angles at all, cannot bee called either *Right* or *Oblique*, but is necessarily distinguished from either. On this distinction of Horizons is grounded the diuision of the Inhabitants of the Earth according to three kinds of Spheares: of whose accidents and proprieties wee shall more fully treat hereafter in the distinction of the parts and Inhabitants of the Terrestriall Spheare, because such proprieties cannot so well be taught without the knowledge of the *Artificiall Spheare*, whose Nature and Fabricke wee shall labour (God willing) in our next Chapter to vnfold.

C H A P. VII.

Of the Artificiall Representation of the Terrestriall Spheare.

HAuing hitherto treated of the Terrestriall Spheare, as it is Naturall or re-
all

all : wee are in the next place to speake of the *Artificiall Globe* : The Artificiall Globe is an expreſſion or imitation of the Spheare of the Earth.

- 2 The Artificiall imitation of the Earth is either *Common* or *Magneticall*. The common is againe twofold ; either in the *Globe*, or in the Geographicall *Mappe*, or *Table*.
- 3 The Geographicall Globe is a round ſolid Body, adorned with *Lincaments & pictures*, ſeruing for the uſe of Geographers.

Who was the firſt Inuentour of this Artificiall Globe, it is not euident: ſome thinke with *Pliny*, that it was found out by *Atlas*, and carried into *Greece* by *Hercules*. Others haue aſcribed it' to *Anaximander Mileſius*; ſome to *Musaſus*, as *Diogenes Laërtius*: others to other Authors, amongſt whom *Architas Tarentinus* is not forgotten, as one that was eſteemed the rareſt Mathematician of his time. But all theſe were out-ſtripped by *Archimedes* the *Syracuſan* Mathematician, who is ſaid to haue compoſed a Spheare of transparent glaſſe, repreſenting vnto the life the whole frame of the Heauens, wherein the *Sunne*, *Moone*, and *Starres* with their true motions, periods, and limits were ſhewed to the ſight, in ſuch ſort, as if it were naturall; where- of *Claudian* the Poët elegantly wrote in theſe Verſes.

Claudian. in Epigrammat.

*Jupiter in paruo cùm cerneret aethera vitro,
Riſit, & ad Superos talia dicta dedit:
Hucine mortalis progreſſa potentia cura?
Jam meus in fragili luditur orbe labor.
Jura poli, rerumq; fidem, legesq; Deorum,
Ecce Syracuſius tranſtulit arte Senex.
Incluſus varijs ſamulatur ſpiritus aſtris,*

*Et vinum certis motibus urget opus.
 Percurrit proprium mentitus signifer annum,
 Et simulata nouo Cynthia mense redit.
 Iamq; suum vuluens audax industria mundum,
 Gaudet & humana sidera mente regi.
 Quid falso insontem tonitru Salmonea miror?
 Emula natura parua reperta manus.*

In a small glasse when *Joue* beheld the Skies,
 He smil'd, and thus vnto the gods replies:
 Could man so far extend his studious care,
 To mocke my labours in a brittle Spheare?
 Heauen's lawes, mans wayes, and Natures soueraigne right,
 This Stage of *Syracuse* translates to sight.
 A soule within on various stars attends,
 And moues the quicke-worke vnto certaine ends,
 A faining *Zodiacke* runnes his proper yeere,
 And a false *Cynthia* makes new monethes appeare:
 And now bold Art takes on her to command,
 And rule the Heauenly Starres with humane hand.
 Who can admire *Salmonean* harmlesse Thunder,
 When a flight hand stirres Nature vp to wonder?

But this Spheare of *Archimedes* I take to be more then an ordinary Globe commonly vsed amongst vs, as may appeare by the Poets description; so that it may rather be likened to the Spheare, lately composed by *Cornelius Trebelius*, and presented vnto *King James*. The like whereof *Peter Ramus* sayes he saw two at *Paris*; yet not of glasse, but of Iron; the one of which *Ruellius* the Physician brought from the spoiles of *Sicily*: the other of which *Orontius* the Mathematician recouered likewise from the *Germane* warres. But of such kind of Globes hauing neuer yet had the happines to see any, I intend no description: In the meane time our common Geographickall Globes may well serue our turnes.

4 In the Terrestriall Globe two things are to be considered: 1 The Fabrick or Structure.

2 The

2 The Vse. 3 The Direction. In the former is taught the composition of the Globe by resolving of it into it's parts.

1 *The parts whereof the Globe is Geographically compounded are circles and pictures.*

To explaine the true composition of the Artificiall Globe, not Physically as it consists of timber and mettall, but *Geographically* as it represents the Earth, we are to consider, that the parts of it are either *Externall* or *Internall*: *Externall* I call those parts which are without the Spheare it selfe, yet necessarily concurre to the constitution of it. These parts are such as concurre to the making of the Stocke or Frame whereunto our Spheare is set: where to let passe the footing or lower board, (wherein in the old Globes was engraffed a *Marriners Compassse*, with a *Needle magnetically* touched, very profitable for the direction of the Spheare) I will onely speake of the great Timber Circle, encompassing round the whole Globe: because it more immediatly concernes our purpose. This Circle represents the *Horizon* of the Naturall Spheare: In the Globe it is made but one, not that there is but one Horizon in the whole Earth; because (as we haue taught) the Horizon is varied according to the places: but because it is impossible to point and marke out the Horizons; for all places being infinite as the Verticall points: yet may this one serue for all places, because the Globe being moueable, may apply all his parts to this circle. This Circle representing the Horizon, is diuided into three borders or Limbes: whereof the first which is towards the Spheare, contains all the *signes* with the *Planets* thereunto belonging; euery of which is diuided into 30 Degrees, which in the Timber Circle are described by set numbers and markes. The second which is the middle-most and largest, containes the *Calendar*, with the Golden number, and severall names of all the Feasts throughout the yeare. The third and last is of the 22 Windes, seruing chiefly for the vse of Marriners, and may serue many wayes for a *Geographer* to distinguish the *Coasts* and

points of the Earth. But of these three borders distinguished in the Horizon, only the last hath use in *Geography*; the other two are in themselves Astronomicall, and placed in the Geographi-
call Globe rather for ornament, then use. The Internall parts of the Globe are either annexed or inscribed in the face of the Spheare. The Annexed part is that which represents the Meridian, which is a Brasen circle: For as the Externall Frame of the Globe contained the Horizon as one circle; so this Meridian is set but one, although it bee in it selfe various, according to the places to which it serue. Neither without good reason is this Circle made of *brasse*, because it should serue for diuerse vses, which require that it should bee often changed and turned to and fro, which being of Timber would miscarry. This Brasen Meridian meetes with the Horizon at two opposite places, cutting it at right angles, that the Spheare included might bee rayed and set lower, as occasion requireth. The Meridian circle is agayne diuided into 4 *Quadrants*, each of which is againe diuided into 90 *Degrees*; so that on the one side the 90th Degree must touch the Pole; on the other side the first degree; so that in all there will arise 360 degrees, described in the Brasen Meridian. Through this Brasen Meridian by the two Poles doth passe a line or wier, which is called the *Axell-tree* of the Globe, about the which the Spheare is turned, the ends of which are commonly called the Poles; whercof the one representing the North point is called the *Pole Articke*; the other shewing the South, is termed *Antarticke*. To this Meridian Circle in the Globe is commonly fastned a little Brasen Circle, named *Cyclus horarius* or the *houre-circle*; but this rather appertaines to *Astronomy* then *Geography*, and therefore wee will forbear to describe it: somewhat more use haue wee of another Instrument fastned to the Meridian, called the *Quadrant of Latitude*; for as much as it may serue to measure the Distance betwixt any two places signed in the Globe: but in so grosse an Instrument little exactnesse can bee expected. Now for such matters as are inscribed in the Spheare it selfe, (to let passe ridiculous & idle pictures vsed of Painters for ornament) they are either *Lines* & *Circles* drawne on the face of the Globe: or else the pictures &
deli-

delineations of Countreies and places, marked out in visible proportions; whereof the former properly appertaines to the *Sphericall* part of Geography; the latter to the *Topicall*. The Circular Lineaments are againe twofold: either Circles necessarily appertaining to the constitution of the Globe, or else Lines thereon drawne to bee considered of Marriners, which we haue before called the *Rhumbes*. But these Lines also (as wee haue taught) appertaine to the *Geographer*, being as many sections of the Horizontall Circle; because they are alwayes imagined to proceed from a Verticall point wherein they meet. The Circles painted on the Globe are either the *Parallels* or *Meridians*, whose description we haue set downe in the chapter before: Amongst the *Parallels* the most remarkable is the *Equatour*, which is made greater then all the rest, in forme of a bracelet, distinguished into degrees, and marked at euery 10. degrees: Next to this are the *Tropicks* and *Polar Circles*, represented only by blacke Lines, yet framed in such sort, that they may easily bee discerned from other *Parallels*. Amongst the *Meridians* the most notable is the first Meridian passing by the *Canaries*, and painted much like the *Equatour*, cut into diuers sections and degrees, in such sort as wee haue described: For the *Zodiacke* which is vsually pictured in the Terrestriall Globe, I hold it altogether needlesse in Geography, and made rather for ornament, then vse; for as much as the periodicke course of the Sun, deciphered by the *Eclipticke*, appertaines rather to the *Theory* of the planets, which is the hardest part of *Astronomy*. The proportion of these Circles, Site, and Distance is taught before, and needs no repetition, sith it is the very same in representation on the face of the Globe, which is really in the Earth it selfe. For the pictures and Topicall description of the Earth, wee referre it to the second and third part of this Treatise; where we shall haue occasion to speake of Countreies and Regions, with their seuerall qualities, accidents, and dispositions.

- 2 The vse of the Artificiall Globe is to expresse
the parts of the Earth so farre forth as they

haue a diuerse situation as well one in respect of another, as of the Heauens.

The vse of the Artificiall Globe is two-fold, either generall or speciall: the Generall is expressed in this Theoreme: the Speciall shall be shewne in diuerse speciall propositions hereafter as occasion shall serue.

5 This Direction is taught in the Rule.

1 The Meridian for the place being found by the Sunne or Compasse. 1 Let the Globe bee so set, that the North Pole respect the North, the opposite the South. 2 Let the Pole in the Meridian of the Globe be set according to the eleuation of the Pole at the place assigned.

6 A Geographickall Mappe is a plaine Table, wherein the Lineaments of the Terrestriall Spheare are expressed and described in due site and proportion.

Some would haue the name of a Mappe to be drawne from the linnen furniture wherewith it is endorced; which is not unlikely, in regard of the affinity of the words in Latine. But more significantly by others it is termed a Geographickall Table or Chart: A Mappe differs from a Globe, in that the Globe is a round solide body, more neerely representing the true figure of the Earth, whereas contrarywise the Charts of themselves are plaine, though representing a Spheare, inuented to supply the wants of a Globe. For whereas a Globe is more costly to be procured of poore Students, and more troublesome to be carried to and fro; a Mappe is more cheape to be bought, and far more portable: And howsoeuer it be not so apt an expression as the Globe, yet are there few matters represented in the other, which may not in some sort find place in this. And certainly

tainly such is the vse and necessity of these Tables, that I hardly deeme him worth the name of a Scholler, which desires not his Chamber furnished with such ornaments. It is written of that learned man *Erasmus Roterodamus*, that hauing seene 50 yeares, he was delighted so much with these Geographycall Mappes, that vndertaking to write Comments on the *Acts* of the *Apostles*, he had alwayes in his eye those Tables, where hee made no small vse for the finding out of the site of such places whereof he had occasion to treat. And it were to bee wished in these dayes, that yong Students instead of many apish and ridiculous pictures, tending many times rather to ribaldry, then any learning, would store their studies with such furniture. These Geographycall Mappes are of two sorts, either Vniuersall or Particular: The Vniuersall are such as represent the picture of the whole Earth. The particular are such as shew only some particular Place or Region. These particular Tables are againe of two sorts; some are such as describe a place in respect of the *Heauens*, whereon are drawne the Geographycall lineaments by vs described, at least the chiefe: some againe are such as haue no respect at all to the *Heauens*; such as are the Topographycall Mappes of Cities and Shires, wherein none of the Circles are described. For the Vniuersall and first sort of particular Maps, there is no question but they properly appertaine to Geography: But the later deserue much lesse consideration, as being too speciall for this generall Treatise.

7 The Geographycall Mappe is twofold: either the *Plaine Chart*, or the *Planisphaere*: The *Plaine Chart* we call that which consistes of one face and Right lines.

Such a Chart wee find commonly set forth vnder the name of the Marriners *Sea-Chart*: for howsoeuer it seemes to haue chiefe vse in Nauigation, yet is the Nature and vse of it more generall: as that which not onely expresseth the *Sea*, but the whole Terrestriall Globe: For as much as the *Parallels*, *Meri-*

dians, and *Rhumbes*, whereof primarily it consists, are circles common to the whole, and not appropriated to either part.

3 In the *Plaine-Chart* we are to consider two things First the *Ground*. Secondly the *Inscription*. The *Ground* is the space or *Platforme* wherein the *Lines* are to be inscribed: the *Inscription* teacheth the manner how to proiect the *Lines*.

In the *Chart* two things are remarkable; to wit, the *plaine* whereunto the *Lines* are inscribed: Secondly the *Lines* or *Inscription* it selfe: so wee are here to handle two points: First how this *Plaine-Chart* should bee conceiued to bee produced out of the *Globe*; whereof it is a representation. Secondly what rule or method wee ought to vse for the inscription of the *Meridians*, *parallels*, *Rhumbes*, and other *Lineaments* thereunto annexed. Both which depend on these propositions.

I *The Geographical Chart is a Parallelogramme conceiued to be made out of a Spheare, inscribed in a Cylinder, euery part thereof swelling in Longitude and Latitude, till it apply it selfe to the hollow superficies of the said Cylinder.*

This Theoreme seeming at the first obscure, consists of many parts, which being once opened, will soone take light. First then to know the *Ground-woke* of this *Parallelogramme* thus defined; wee must suppose a *Sphericall superficies*, *Geographically* or *Hydrographically*, with *Meridians* and *parallels* to bee inscribed into a *concaue Cylinder*, their *Axes* agreeing in one. Secondly wee must imagine the *superficies* thus inscribed, to swell like a *bladder*; blowing equally in euery part, as well in *Longitude*, as *Latitude*, till it apply it selfe round about; and all along towards either pole, vnto the *concaue superficies* of the *Cylinder*; so that each *parallell* on this *superficies*, successiuely
grows

growes greater from the Equinoctiall towards either Pole, vntill it challenge equall Diameter with the Cylinder: and likewise all the Meridians growing wider and farther off, till they bee as farre distant euery-where as is the Equinoctiall one from the other. Hence may easily bee vnderstood the true Mathematicall production or generation of this part: for first of a Sphericall superficies it is made a Cylinder: and secondly of a Cylinder it is made a Parallelogramme, or plaine superficies: For the concave superficies of a Cylinder is nothing else but a plaine Parallelogramme, imagined to bee wound about two equall equidistant circles, hauing one common Axell-tree perpendicular vpon the Centers of them both; and the *Peripheries* of them both, equall to the length of the Parallelogramme, as the distance betwixt those Centers is equall to the bredth thereof: In this Chart so conceined to be made, all places must needs be situate in the same Longitudes and Latitudes, Meridians, Parallels, and Rhumbes, which they had in the Globe it selfe: because we haue imagined euery point betwixt the Equatour and the Poles, to swell equally in Longitude and Latitude, till it apply it selfe to the concavity of the cylinder: so that no point can bee displaced from his proper seat, but only dilated in certaine proportion. And this I take to bee the best conceit for the ground-worke or plat-forme of this Geographicall Chart.

- 2 *Except the distances betwixt the Parallels in a Plaine-Chart be varied: it cannot bee excused from sensible error.*

It hath beene thought by many Geographers, that the Earth cannot aptly according to due symmetry and proportion be expressed in a plaine superficies, as it is in the Globe: for as much as that which is ioyned and vnited in the Globe, being of a Sphericall figure, is in the Mappe extended and dilated to a diuerse longitude and latitude from that Sphericall delineation: and although it hath been generally conceited by many writers, that no due proportion could bee obserued in a Sphericall superficies, without sensible error: yet most exception hath beene made against this *Chart* here mentioned, consisting of one face
and

and straight lines, which in substance (if we consider the Circles) differs not from the Nautical Chart: of whose errors *Martin Correse*, *Peter Nonnus*, and many others have complained: which escapes are excellently opened and reformed by our Countryman *Edward Wright* in his *Correction of Nautical Errors*. The reason or ground which drew these men to thinke that the Earth could not be proportionably described in a plaine superficies, proceeded from the common proportion of the Lines and Circles on the Chart. For supposing the Parallels cutting the Meridians at equall Angles, to observe an equall distance euery-where one from the other; these errors and absurdities must of necessity ensue. First, what places soever are delineate in the ordinary Chart, the length of them from East to West hath a greater proportion to the breadth from North to South then it ought to have, except onely vnder the Equinoctiall: and this error is so much the more augmented, by how much those places are distant from the Equinoctiall: for the neerer you approach the Pole, the proportion of the Meridian to the Parallell still increaseth; so that at the Parallell of 60 degrees of latitude, the proportion of the length to the breadth is twice greater then it ought to be; for as much as the Meridian is double to that Parallell, and so in all the rest: whence as *Edward Wright* observes, the proportion of the length of *Friesland* to the breadth thereof, is two-fold greater then in the Globe which expresseth the true proportion; because the Meridian is double to the Parallell of that Island. In like sort it is plaine, that in the Islands of *Grock-land* and *Groen-land*, the length to the breadth hath a foure-fold greater proportion in the Common Chart, then in the Globe; because the Meridian is foure-fold greater then the Parallell of those places. Wherefore it cannot be conceited, that the manner of finding out the difference of Longitude by the common Chart, can be any-where true without sensible error, except onely vnder the Equinoctiall, or neere about it; because in no other place the Parallell is equall to the Meridian. In other places the error will be sensible, according to the difference of the Meridian, and Parallell of that place: whereas if the contrary

were

were granted, it would follow, that two ships sayling from North to South, vnder two feuerall Meridians, would keepe the same distance the one from the other of longitude neere the Pole, which they had neere the Equatour; which is impossible: because Meridians cannot bee Parallell the one to the other, but by how much they approach the Pole, by so much they are neerer, that in the end they all concurre and meete in the Pole it selfe. Secondly this common Chart admitted, there would arise great errors not onely in the situation of diuers places, which appeare to bee vnder the same Meridian, but also in the bearing of places one to the other. The reason is manifest, for that the Meridian is a certaine Rule of the site and position of places: therefore whensoever any error shall be committed in the Site and Position of the Meridian, there must needs follow errors in the designation of the Rhumbes, and other points of the Compasse. And therefore euery respec^tive position of place to place, set downe in the common Chart, cannot bee warranted. A pregnant example wee haue in the way from *India*; for the Promontory of *Africke*, called the Promontory of three Points, hauing of Northerne latitude 4 Degrees and a halfe, and the Island of *Tristan*, *Acugna*, hauing 36 degrees of Southerne latitude, are in the common Chart set vnder the same Meridian: But the Chart sheweth the distance betweene these Islands, and the *Cape of good Hope* to come neere to 400 leagues; both which cannot stand together; for if all the coast from the Promontory of *Three Points*, vnto the *Cape of Good-hope* be rightly measured, and the Promontory of *Three Points* lye also vnder the same Meridian with those Islands, yet must the distance bee much lesse: But if it be not lesse, it cannot stand with reason that it should haue the same Meridian with the Promontory of *Three Points*, but must needs lye more Westward. Thirdly, there must needs arise a greater error in the translating Sea-coasts and other such places out of the common Chart, into the Globe; because they haue only a respect to the Numbers of Degrees of Longitudes and Latitudes found therein; so that not onely errors appeare in the Sea-Chart, but also other-where thence deriued. These and many more errors haue been

dete-

detected in the common Sea-chart, which (as we haue said) respecting the circles, ought to be imagined one and the selfe-same with the projection of the lines in a Geographical table; which ouersight *Ger. Mercator* in his vniuersall Map seemes to correct: yet leaues no demonstration behind him to teach others the certaine way to draw the Lines, as Meridians, Parallels, & Rhumbes on the Chart, in such sort, as these errours might be preuented, and the due proportion and symmetry of places well obserued. But our industrious Countryman hath waded through all these difficulties, and found out the true demonstration of a projection of these Lines to be inscribed in the Chart in such sort, as no sensible error can shew it selfe, from whose copious industry wee will extract so much as may serue our purpose, onely contracting his inuention into a shorter method, hauing many matters to passe through in this Treatise.

2 *The Distances of the Parallels in the Chart must encrease proportionably as the Secantes of the latitude.*

It hath been a conceined error (as we haue shewed) that all the parallels in the Chart here mentioned, should euery-where keep the same Distances one from the other, from the Equator to the poles; yet because no man (for ought I know) hath out of Geometricall grounds discovered the true proportion, beside my fore-named Author; I must herein also follow his direction as neere as I can in his owne footsteps; because I would not any way preiudice his Inuention. First therefore wee must consider in that chart, because the parallels are equall one to the other, (for euery one is set equall to the Equinoctiall) the Meridians also must bee parallell and straight Lines; and by consequence the Rhumbes, making equall angles with euery Meridian, must bee also straight lines. Secondly, because the sphericall superficies whereof the Chart is imagined to be produced, is conceined to swell and enlarge it selfe euery-where equally, that is, as well in Longitude as Latitude, till it accommodate it selfe to the hollownesse of the Cylinder round about: therefore at euery point of Latitude in this Cylinder so dilated, a

part

grounds thus explained, will arise a certaine and easie methode for the making of a table by the helpe of Trigonometry, whereby the Meridian in any Geographicall or Hydrographicall table may truly and in due proportion diuide it selfe into parts, from the Equinoctiall towards either Pole: for taking for granted, each distance of each point of latitude, or of each Parallell one from the other, to comprehend so many points as the secants of the latitude of each point or Parallell containes, wee may draw out a table by continuall addition of the secants answerable vnto the latitude of each Parallell, vnto the summe compounded of all the former Secants; beginning with the secants of the first Parallels latitude, and thereunto adding the second Parallels latitude, and to the summe of both these, adding the third Parallels latitude, and so forth in all the rest: and this Table will shew the sections and points of latitude in the Meridian of the Geographicall Mappe; through which sections the Parallels ought to bee drawne: which Table wee haue lately set out by *Edward Wright* in his *Correction of Nauticall Errours*, to whom for further satisfaction in this kind, I referre the diligent Reader. Out of the same grounds we may also deduce the Rumbes: for sith that the Chart (as wee haue shewed) is nothing else but a plaine *Parallelogramme*, conceiued to be made of the extension of a Sphericall superficies, inscribed in a concaue Cylinder, it must needs be that the Rumbes make equall Angles with all the *Meridians*. Therefore if in the Chart a circle be drawne, diuided into 32 equall parts, beginning with the *Meridian*, passing by the Center of that Circle, the lines drawne from the center of these sections, will be the Rumbes for that place.

- 9 Of the Geographicall *Plaine-Chart* wee haue spoken; It behoues vs next to treat of the *Geographicall Planisphære*. The Planisphære is a table or mappe of two faces, whereon the lines are projected circularly.

Between the Planisphere and the Plaine-Chart, a double difference may be observed: 1 That the former consists altogether of right lines, as well in regard of the *Parallels* as *Meridians*: whereas the later is composed of circular or crooked lines, as well as right. 2 The former may well bee expressed in one forme or front, as we may see not only in the Nauticall and common Chart; which wee haue shewne to be all one with the other in respect of these Lines; but in many other common Maps, as namely those of *Hondius*, whereas the Planisphere cannot be expressed without two faces or Hemispheres; whereof the one represents the Easterne, the other the Western part of the Terrene Globe: For herein wee must imagine a Globe to be cut into two equall Hemispheres, which are at once represented to our sight: of this Description of the Earth by crooked Lines, *Ptolomy* in his 24 Chapt. of his Geography hath taught vs two wayes: whereof the first depends from the aspect of a Sphere, turned and moued round, in which all the Meridians are described as right Lines; but the Parallels as circumferences or crooked Lines. The other Delineation takes his ground from a Sphere represented to the sight, not moued, but resting still in his place, in which both Meridians and Parallels are drawne circular. These two wayes of *Ptolomy* (how fouer iudiciously inuented in those times, wherein a small part of the Earth was discovered, and Geography very vnperfect) haue beene by later Geographers much reformed and corrected. Yet amongst the later haue not all expressed themselves alike: some haue portrayed out of the Earth in fashion of a Heart; some according to other figures: but in this (perhaps) as Painters, they haue beene more indulgent to fancy, then common vse: others haue gone about to expresse the Globe of the Earth in Ellipticke Lines, which the *Mechanicians* call ouall. But wee as well in this as other matters, preferring choice before abundance, will content our selues with one or two, which vse hath stampt more current, and experience hath found most vsfull: to which as a ground we will premise this Theoreme.

- 1 *The Planisphere is grounded on a certaine aspect*

aspect of the Terrestriall Spheare, wherein the Eye of the beholder is so conceiued to bee fixed in some point of the Globe, that it may see the one halfe or Hemisphere.

Concerning the position of the Eye, two things are here remarkable: 1 Where the Eye is supposed to bee placed either about the conuexe superficies, or in the concaue: some seeme to place it about the conuexe superficies; of which opinion *Gemma Frisius* seemes to be, who would haue the Eye to be set at an infinite distance: others although not admitting of such an infinite distance, deny not the Eye to bee about the conuexe superficies: but neither way can be warranted: Not the former, because of the impossibility of the supposition. For to imagine the Eye to bee set at an infinite distance, were to deny a sight or aspect which they would haue to bee the ground of this projection: For no object can bee perceiued, but such as is bounded and determined in a certaine and proportionate space. Neither can the later way passe cleere without exception; because to such a projection, such a sight is required which can see the whole Hemisphere: for otherwise would it be vnperfect, and want of the perfection of the Globe: which contains two absolute and entire Hemispheres. But now no place can be imagined without the Globe, wherein the Eye can be so placed, as to see the one halfe or Hemisphere: for as much as it is impossible from the opposite points of any Diameter, to draw two tangent lines which may meet together, or cut one the other in the same point, but will bee Parallell the one to the other: wherefore wee may conclude, that the Eye in this projection cannot be imagined without the conuexe surface of the Spheare, but rather in the concaue: How the Eye should bee imagined to be in the concaue superficies, may be in this sort explayned: wee must suppose a great Spheare of the Glasse, or other such Diaphanous matter, inscribed with all his Parallels and Meridians, in such sort as they are represented vnto vs in the Globe, the Eye (according to optically Principles) may bee so placed neere the center

Center of it, as it shall bee able to see precisely the one Hemisphere described with all his circles, as we find it in the sphere. I say *neere* not in the Center: because the *Angle* of vision (as we finde it taught in the *Perspectives*) doth not extend to a right Angle, but is somewhat lesse: 2 we must inquire in what point in the superficies the eye is placed. To which wee answer, that the place of the eye is of it selfe indifferent; because it may bee imagined any where in what point focuer. Neuerthelesse wee will only fasten on two especiall wayes which are of most vse; wherein the propositions following shall informe vs.

9 This Planisphere is twofold: the first we tearme equinoctiall, which supposeth the eye to be fixed on some point of the equinoctiall circle; the other Polar, wherein the sight is conceiued to bee fixed on the Pole of the Terrestiall Globe: The ground and fabricke of the former is taught in these Propositions.

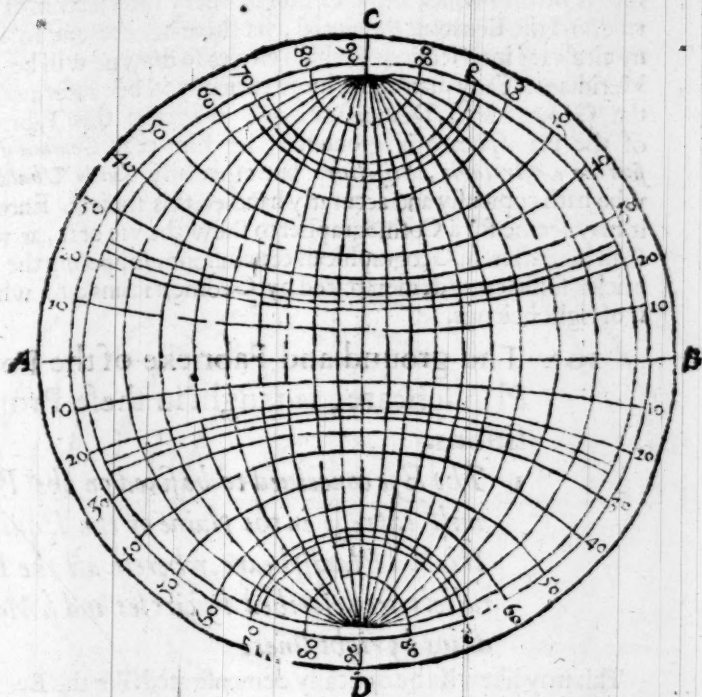
1 *The eye conceiued to be fixed on any point of the equatour, will designe out vnto vs a Planisphere wherein all the circles are projected circularly, except the Equator and that Meridian which passeth by the said point.*

This may easily bee shewne out of the Opticke principles, we will suppose for example sake the eye to bee placed in some point of the Equatour: which shall bee 90 degrees of longitude from the Equinoctiall point: which kinde of projection wee haue in many of our common Geographickall Maps of the earth. In this manner of sight, if the terrestriall Hemisphere, which may only be comprehended by it, be distinguished by his Parallels and Meridians ordered and ranged by distances of equall

Arches in such number as we please : It is most certaine that the Eye, seeing distinctly and separatly euery one of these Meridians and Parallels, will forme to it selfe so many visuall Pyramids, called by Geometricians Cones, which cones by this meanes will be Scalenes, and will haue for their Bases those Meridians and Parallels, the tops whereof will meet together in the same point and eye of the beholder, which according to this supposition is the Pole of the Meridian, which passeth by the Canaries, called the first Meridian, and representing vnto vs the Equinoctiall colure. Now because these lines are cut by the plaine of the Meridian passing by the Canaries, it followes out of the same grounds, that their common sections, and that of the Meridian are the proportions of circumferences, which represent vnto vs in this Plaine the Meridians and Parallels seene in this manner of sight. Notwithstanding that which is vnder the 90 degree of longitude, as likewise the Equatour, cannot (according to Opticke demonstration) be seene, but as right lines cutting one the other at Right Angles in the Center of the same Meridian of the Canaries : The Theory being expressed we will in the next proposition shew the manner of projection,

2 *How to describe the Meridians and Parallels in the Equinoctiall Planisphære.*

To shew the practise of this Theoreme, let there be drawne a circle A C B D, as you see in this figure diuided by two Diameters cutting on the other at right Angles in the Center into foure Quadrants, or equall parts : whereof each one is againe to bee diuided into 90 degrees. In this the line A B is imagined to expresse the halfe of the Equatour, as the line C D of the Meridian; in which the two points C and D designe out the two Poles. Let a rule bee drawne from the Pole C by euery tenth or fift degrees of the halfe circle A D B, and let euery section of the Equatour and the rule be precisely noted. In like sort from the point B let the Rule bee moued by euery fift and tenth Degree of the semicircle C A D, and let euery seuerall Interfection of the rule and the Meridian C D bee precisely noted. Then placing



cing one foot of the compasse in the line CD (which must bee drawne out longer, because in it the Centers of the Parallels must be found out) let the other be moued in order to euery interfection of the Meridian noted out : and let so many circles be drawne as interfections, which circles will bee so many Parallels. The finding out of the Centers where the stedfast foot of the compasse ought to bee fixed in drawing of each circle, is a matter appertaining to Geometricians : who haue taught a way to bring any three points giuen into a circle, and to finde the Center from which it is described. Hauing thus described the Parallels, wee must proceed on to draw the Meridians in this maner : let the one foot of the compasse bee placed in the

line A B, from which as the Center by euery Intersection of the rule, and the Equatour forenoted, let there bee drawne so many circles as intersections; which circles so drawne will be the Meridians. If any man desire more curiously to bee informed in the Geometrical Demonstrations, whereon this Fabricke of the Planisphære is grounded, let him read *Gemma Frisius de Astrolabio, Stifelius*: but especially *Guido Vbaldus*, who hath copiously and accurately handled this subiect. Enough it may seeme for a Cosmographer to shew the vse of it, as wee shall hereafter in Geographical conclusions, supposing the Fabricke sufficiently demonstrated by Geometricians, to whom it of right belongs.

10 The ground and Fabricke of the Polar Planisphære, is taught in these Propositions.

1. *The Eye conceiued to be fixed on the Pole will expresse in the plaine of the Equinoctiall a Planisphære, wherein all the Parallels are described by circles and Meridians by right lines.*

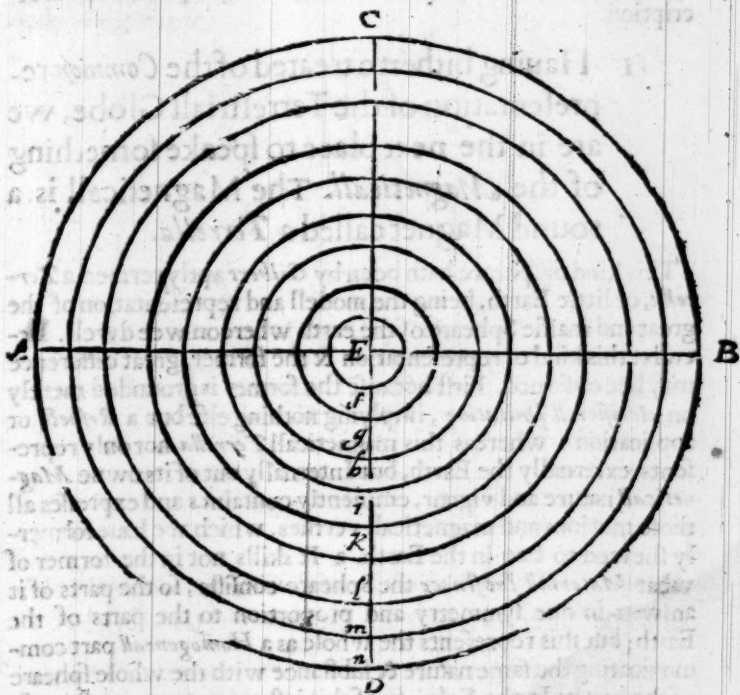
This may likewise be optically demonstrated: For the Eye being supposed to bee fixed on the Pole, the sight will forme to it selfe so many visuall Cones as there are Parallels described in the Spheære. These cones being supposed equally to be cut by the plaine of the Equatour, will haue for their Bases the said Parallel circles represented in the plaine of the Equatour, as so many absolute circles; whereof the Equatour will be the greatest, and comprehending within it all the rest. Likewise the Meridians in this kinde of sight are supposed to terminate the sides of these Cones, and therefore according to the Opticks ought to be right lines.

2. *How to describe the Parallels and Meridians*

in

in the Polar Planisphaere.

This projection is easiest of all, as shall appeare by this Diagram. Let there be described a circle from the Center E which shall be ACBD: Let the circle be by two Diameters AB and BC diuided into foure quadrants: each of which may againe



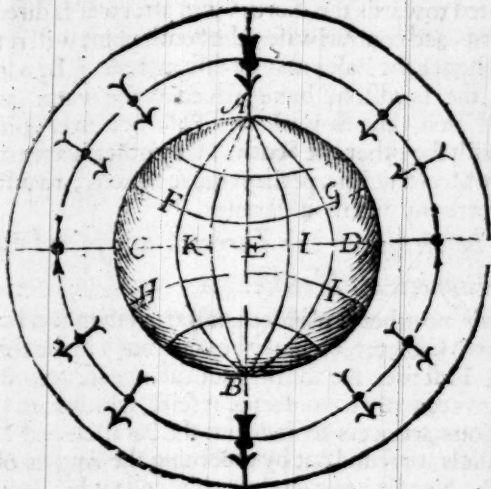
bee diuided into 90 parts: cuery fift or tenth of these 90 parts being first marked out, so many Diameters may bee drawne from either side to the opposite part by the Center E: which Diameters so drawne will serue for the Meridians. Then let any one of these lines bee diuided into 9 parts, and diligently marked out, as the Semidiameter ED by FGHIKLMN: by

all which marks from the Center E, let there be drawne so many circles. These circles so described will be the true Parallels: This kinde of projection, though more vnusuall, yet wants not his speciall vse in describing the parts of the earth neere the Pole, which in our ordinary kinde of Tables projected after the other manner, cannot suffer so large and proportionall a Description.

II Having hitherto treated of the *Common* representation of the Terrestriall Globe, we are in the next place to speake something of the *Magneticall*. The Magneticall is a round Magnet called a *Terrella*.

This kind of spheare hath been by *Gilbert* aptly termed a *Terrella*, or little Earth, being the modell and representation of the great and masse Spheare of the earth whereon wee dwell. Betwixt this kind of representation & the former, great difference may bee obserued. First because the former is grounded merely on *Artificiall Imitation*, implying nothing else but a *Respect* or application: whereas this magneticall *Terrella* not only represents externally the Earth, but Internally out of its owne *Magneticall* nature and vigour, eminently containes and expressees all those motions and magneticall vertues, which we haue formerly shewed to bee in the Earth. 2 It skills not in the former of what *Materiall substance* the Spheare consists, so the parts of it answer in due symmetry and proportion to the parts of the Earth; but this represents the whole as a *Homogeneall* part communicating the same nature & substance with the whole spheare of the earth: In the *Fabricke* of this instrument wee must consider, 1 the *Matter*: 2 the *Forme*: The matter (as wee haue already intimated) is a *Magneticall* substance which ought to be chosen out of a most eminent Mine, hauing all his parts pure and vnmixt, as possible wee can finde in any Magnet. For though all Loadstones haue the same inclination, yet in many the vigour is so weake, or at least so hindered by the mixture of some *Hetero-*
geneall

generall matter, that they will not so well and sensibly performe their office. The forme of it is the roundnesse & politure, wherein Art should shew as much exactnesse as shce can: such a Spheare may well be expressed in this Figure, whereof we had formerly occasion to make vse: wherein the footsteps of this Magneticall vigour are sensibly expressed, no otherwise then in the great Body of the Earth.



12 In this Magneticall Terrella two things are chiefly to bee noted, 1 the inuention of the Poles, 2 of the *Parallels & Meridians*: both which shall be taught in these Propositions.

1 To finde out the Poles in the Magneticall Terrella.

To performe this conclusion many artificiall wayes haue been inuented, 1 By the *Inclinatory Needle*: for being euently hung in such sort vpon the Terrella, as may be seene in the former figure

it will according to diuers points diuersly respect the Terrella in his site : wherefoeuer then wee shall finde it to fall perpendicularly as right angles, wee may assure our selues that that very point is the Pole : which being once knowne, it will be easie to finde the opposite Pole, either the same way, or by measuring.

2 By the Veyne or Mine of the Loadstone : for (as wee haue shewed in our fourth Chapter of this Treatise) that part which was situated towards the North, will afterwards direct it selfe Southward, and contrariwise, the South point will respect the North, whence the Poles may be discouered.

3 By a little boat, wherein the Loadstone being placed on the water, will moue round till such time as with one Pole hee may point out the North, with the other the South. Many other wayes may be inuented by Mechanicians, perhaps more curious, to whose industry I referre my ingenious Reader.

2 *The circles in the Terrella are found out by the Magneticall Needle.*

This needs no other ocular demonstration then we haue taught in the fourth Chapter, and may be conceaued in the former Diagramme; First wee see the magneticall needle according to diuerse points diuersly to conforme it selfe, which hath giuen way to ingenious artificers to finde out the Parallels and Meridians. The Parallels are found out by obseruing the Angles of declination of the Needle hung ouer the Terrella which are found in proportion to answer to the degrees of Latitude; which Dr. Ridley in his Magneticall Treatise hath industriously calculated, as I haue here inserted, to saue others a new labour of calculation. The Meridians are more easily found by hanging any direction wiew or needle ouer the Terrella; one end of which pointing towards the North, and the other towards the South, will discouer the Meridian line.

CHAP. VIII.

Of the measure of the Terrestriall Globe.

Hitherto haue we handled the Terrestriall Globe primarily : in such proprieties as absolutely agree vnto its nature. In the second place we are to handle such as secondarily arise out of the former. Here wee are to handle two chiefe points. 1 The *Measure*. 2 The *Distinction*.

2 The *measure* is that by which we find out the quantity of the whole Earth.

Good reason haue we to call this the *Secondary* part of *Geography*; for as much as these accidents and proprieties we here consider, arise altogether out of the former. In the former Treatise wee haue diuided the *Naturall* Spheare of the Earth, from the *Artificiall* : But in this part, for auoiding of tedious repetitions of the same things, wee haue ioyned them together : For howsoeuer the measuring and distinctions of the Earth bee truely grounded on the nature of the earth it selfe; yet can it not be well expresseed and taught without the materiall Instrument; we haue therefore thought good to consider the measure of the earth, before wee come vnto the Distinction, because it is more simple and vncompound, depending on the lineaments and measure of one circle : whereas the Distinction necessarily requires the conjunction and combination of diuerse circles, as *Meridians* and *Parallels* compared one with the other, as shall bee taught hereafter. Whether the great masse of the earth can bee measured, or no, seemes a matter not agreed on by all; Some haue held an opinion that it cannot bee measured, in regard of the

the infinite magnitude wherewith they thought it endowed : which opinion seemes deriued from some of the *Platonicks*, who ascribing to the Earth another figure besides the *Sphericall*, haue cast themselves vpon vncertainties, and being not able to reduce the Quantity of the Earth according to their owne grounds to any certaine measure, haue denied it to bee measurable : But the ground of this opinion wee haue taken away before, in prouing the earth to be of a true *Sphericall* nature and therefore circumscribed in certaine bounds apt to be measured. Another conceit more absurd then the former, is not only the common people, whose condition might excuse their ignorance, but of such as would bee esteemed learned, who contend, that the greatnesse of the earth cannot bee measured : the onely reasons they can alledge for themselves are, 1 That a great part of the earth is vn-accessible by reason of steepe rocks, high mountaines, spacious and thicke woods, moorish fogges, and such like impediments. 2 That the parts of it are for the most part vneuen, and subiect to no regular figure, without the which no measure can bee exact. The first cauilt is of no moment ; because whereas wee affirme that the Earth by man may be measured, we hold it not necessary that it should be trauersed ouer by iourneyes or voyages. For as much as to the finding out of the Quantity of the whole Terrestriall Spheare, it may seeme sufficient to know the measure and proportion of any little part in respect of the Heauens. As for example, what number of *Miles*, *Leagues*, or *Furlongs* answer to any *degree* or *degrees* in the Heauens : wherefore we suppose the Earth to be measured ouer not with our feet, but with our wits, which may by Mathematicall rules be taught to march forward where our legges fayle vs : The second obiection only proues thus much, that the Earth partaking of so many vnequall parts and irregular formes, cannot in the measuring admit of so much exactnesse, as if it were endowed with one vniforme face: yet it is exact enough to content a *Cosmographer*, who measureth not by feet and inches, but by leagues and miles, in which wee little regard such a needlesse curiosity.

I The common measure by which the quantity of the Earth is knowne, are Miles and Furlongs.

Here is to be noted that such instruments as serue for measuring are of two sorts, either greater or lesser; the smaller are of diuerse sorts, as a *Graine, Inch, Foot, Pearch, Pole*, and such like. Some of these howsoeuer sometime vsfull in *Topographie*, can haue little or no vse at all in the vast greatnesse of the whole Earth. Wherefore the *Geographer* seldome descends so low, but takes notice of greater measures, such as are *Miles & Furlongs*: where we may obserue by the way, that the visuall measuring amongst the *Grecians* was by *Stadia* or furlongs, amongst many of the *Latines* by *miles*: vnder which we also comprehend *Leagues*: these miles are diuersly varied, according to the diuersity of Countries, so that in some places they are esteemed longer, in other shorter: which differences may be learned out of this ensuing Table.

| | | | |
|--|-----------------------------|---|--|
| The instruments of measuring the Earth are | | 1 Furlong containing 125 Geometicall paces or 625 feet. | |
| | | 1 Proper containing 8 Furlongs or 1000 paces. | |
| The instruments of measuring the Earth are | 2 Mile which is either | 1 League, which is either | 1 Old, containing 12 Furlongs. |
| | | | 2 Newer containing 16 Furlongs. |
| | | | 3 Common of 24 Furlongs. |
| | 2 Improper, which is either | 2 German mile which is either the | 1 Common, which is 32 Furlongs or foure Italian miles. |
| | | | 2 Greatest, containing 5000 paces which is called the <i>Suenian</i> , or <i>Heluetian</i> mile. |

Howsoeuer this Distinction of miles may be many wayes profitable especially in the *Topographicall* part, yet shall wee seldome make vse of any other then the common *Germane* mile, or the common *Italian* mile: To which as the most knowne, the rest may easily be reduced.

3 The obiect here proposed to bee measured is the Spheare of the Earth. The Dimensions according to which it is measured, are either *Simple* or *Compound*.

4 The simple is twofold, either the *Perimeter*, or the *Diameter*. The *Perimeter* otherwise called the circumference, is a great circle measuring the Earth round about.

5 The *Invention* of the *Perimeter* of the Earth depends on these following Propositions.

1 If two or more circles bee drawne about the same Center, and from the Center to the Circumference be drawne two right lines; The Arches of all the Circles comprehended within the said right lines will bee like and proportionall one to the other.

This Proposition being meerely Geometricall, is taken here as a ground without farther demonstration: whereof if any man doubt, hee may haue recourse to *Clavius* Commentaries vpon *Iohannes de Sacrobosco*. This principle granted will beget these two Consequences.

1 As one degree is to the number of correspondent miles, or furlongs, so all degrees of the circles to the number of miles or Furlongs measuring the quantity of the *Perimeter* of the Earth.

2 Wherefore one degree or portion of the Circle

ele being knowne by his number of miles or furlongs, the whole Circumference may be found out.

The reason of this consequence every *Arithmetician* can easily shew out of the *Golden Rule*: The chiefe point then of the inuention consists in finding out the proportion of any proportion, as a degree, halfe degree, or the like, to the number of miles or Furlongs answerable thereunto; for which purpose many skillfull *Mathematicians* haue inuented many excellent wayes of great vse and delight.

I *By the eleuation of the Pole, or obseruation of an Eclipse, or some knowne Starre, the circuit of the Earth may be found out.*

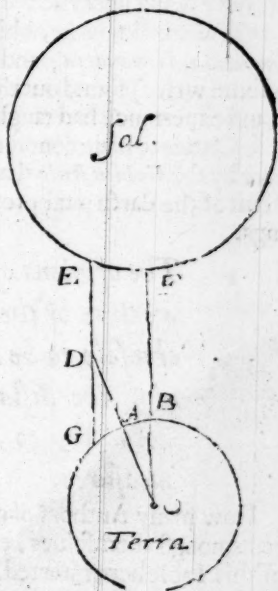
By the Eleuation of the Pole it is performed after this manner: let there be obserued two *Cities*, or other notable *Land-mark*s placed iust North and South vnder the same Meridian. In these two Citties, or markes, let the Eleuation of the Pole be exactly noted, Then subtract the Eleuation of the Southerne Cittie which is lesser, out of the Northerne, which is greater: the residue contains the distance of these places in degrees; which being experimentally knowne by Miles, Halfe-miles, Furlongs or such like measures, will shew the true proportion betwixt a degree, and his number of miles: which being againe multiplied by 360, will shew the whole circumference of the Earth. For example sake, wee will take two famous *Cities* of *England*, *Oxford* and *Yorke*; which are situated, if not exactly, yet very neere the same Meridian. The eleuation of the Pole here with vs at *Oxford* is 51 degrees and 30 minutes; at *Yorke* it is 54 degrees 30 minutes, or neere there about: subtract the lesser from the greater, the distance betwixt *Oxford* and *Yorke* will bee three degrees; which distance experimentally knowne in miles, will shew the proportion: which wee shall finde to bee, (abating somewhat in regard of the crookednesse of the way) about 180, answering to three degrees of the Meridian: wherefore

wherefore to one degree will answer 60 Miles, which being multiplied by 360, the whole circle will produce 21600, the measure of the whole Earth. The like may bee performed by an Eclipse in two Citties lying vnder the Equinoctiall circle: two land-markes being once noted out, lying vnder the Equinoctiall, let there bee obserued in both the same Eclipse of the Moone, especially in the beginning: Now it being certainly found out how many houres the Eclipse beganne in the one place before the other, wee must resolue their houres into degrees, which is easily done: for as much as to euery houre answeres 15 degrees in the Sunne Diurnall motion, according to Astronomers. Now the distance betweene these two Citties or markes (being supposed first experimentally to be knowne, will easily shew the correspondency betwixt the Degrees and miles, which is here sought. Another way is taught by *Possidonius*, as easie as the former, which is performed by some noted fixt Starre, as *Oculus Tauri*, *Arcturus*, *Spica Virginis*, or any other; let there bee obserued vnder the same Meridian in the Earth two places, whose distance is experimentally knowne: in both these places let the Meridian altitude of the Starre be fully and perfectly obserued: The difference of these two Altitudes will bee the number of degrees betwixt these two places: whence we may obserue how many miles, or other parts answer to the number of these degrees betwixt these two places. This way by *Clauius* is preferred before the former; for as much as it requires not in any place the knowledge of the Eleuation of the Pole, which in any place cannot be certainly knowne, without long and diligent search, and obseruation: As for Geographicall Tables, they are not alwayes at all times to be had, at least worthy credit.

2 By the obseruation of the Noone-shadowes the measure of the Earth may be found out.

This way was inuented by *Eratosthenes* a famous Mathematician: who by obseruation of the Noone-shadowes, obserued at the same time at two diuerse places, situate vnder the same Meridian, found out the circumference of the Earth. The pla-

ces which he chose for this purpose were *Siene*, and *Alexandria*, situated vnder the same Meridian: the one inclining to the South, the other to the North. The Distance betwixt these two places is supposed to be knowne, whence hee proceeded in this manner: First he erected a *Gnomon* at right Angles on the plaine of the Horizon: when the Sunne was in the beginning of *Cancer* called the *Solstice*, from which he imagined two *Rages* or *Beames* to be cast at Noone: the one passing by *Siene* the most Southerne part, the other by *Alexandria* the most Northerne: so that at *Siene*, the Sun being then in the *Solstice* passed into the Center of the world; the place being supposed to haue beene situate vnder the *Tropicke*: The other passed by the *Vertex* of the said *Gnomon*: whence by proportion of the shadow to the *Gnomon* by a *Geometricall* kinde of working he found out the space betweene *Alexandria*, and *Siene*: which demonstration, for more euidence wee will here set downe: Let there bee in the Earth described a circle passing by *Alexandria* and *Siene*; in which let A bee the place where *Alexandria* stands: B the place of *Siene*: the *Gnomon* or Style erected at *Alexandria*, A D, The Sun-beame carried to the Center of the world at *Siene* F B C, The Sunne-beame passing by the *Vertex*, or toppe of the *Gnomon* seated at *Alexandria* E D G, casting his shadow A G toward the North: let the *Gnomon* be conceaued to bee prolonged vnto the Center C: Now for as much as in the *Triangle* A D G, the Arch A G, without any sensible difference may bee taken for a Right line, hauing an insen-



sible

sible magnitude in regard of the whole Earth: and the Angle *A* is a right angle, and the two sides *AD*, and *AG* knowne: the former by supposition, being a *Gnomon* taken at our pleasure; the latter by any measure, or at least by the knowne proportion of the shadow to the *Gnomon*, according to the Doctrine of Triangles: the Angle *ADG* will bee knowne; For whereas the sides *AD*, and *AG* are supposed to be knowne, their Quadrants also will be knowne, which being equall to the square made of *DG*, by the 47 proposition of the 1 of *Euclide*, the right side *DG* will easily be knowne: out of these grounds by the doctrine of the *Sines* and *Tangents* is easily found out the Angle *ADG*, and by consequence the alternate Angle *ACB*, which by the 27 of the first of *Euclide* is equall vnto it: for as much as the two Radii *FB* and *FD* may be supposed to bee Parallels in so small a distance as *Alexandria* & *Siene* compared with the *Sun*: the Angle being knowne the Arch *AB* subtended to the Angle *C*, will also be knowne, which is the space intercepted betwixt *Siene* and *Alexandria*; and for example sake: if *Eratosthenes* (as some write) found out the Arch *AB*, to containe in degrees 85, and experience had taught the length of the Journey betwixt these Citties to haue contained 6183 $\frac{1}{2}$ Furlongs: It would appeare by the *Golden Rule* that 360 degrees containing the whole circuit of the Earth must proportionally answer to 252000 Furlongs.

- I *The opinions of Cosmographers concerning the measure of the Earth, are diuerse: which is chiefly to be imputed to their error in observing the distances of places experimentally according to Miles, Furlongs, or such like measures.*

How many Authors of great name and estimation haue differed amongst themselves, euery man may enforme himselfe out of this Table here inserted. These differences wee finde diuersly related: but of all others, which Authors haue set forth,

| | Authors | Furlongs | Miles. |
|--|------------------------------------|----------|--------|
| | Strabo and Hipparchus | 252000 | 31500 |
| | Eratofthenes. | 250000 | 31250 |
| | Poffidonius & the ancient Arabians | 240000 | 30000 |
| The circuit of the whole earth contains according to | Ptolomie. | 180000 | 22500 |
| | The later Arabians | 204000 | 25500 |
| | Italians and Germans. | 172800 | 21600 |

I preferre the iudgements of *M^r Robert Hues*; For as much as it is not grounded on common tradition, but industriously by himfelfe deriued out of the Ancients by diligent fearch and examination, as by one, whose iudgement being armed as well with skill in the language, as the knowledge of antiquity, feornes to be iniured by translation: What fhould bee the caufe of thefe differences, is a matter which hath staggered curious fearchers into Antiquities, more then the former. Euery opinion being supported with the names and authorities of fuch renowned Authors, might challenge a pitch aboue the meafure of my Decifion: only I may not bee thought ouer prefumptu-

ous to coniecture where I cannot define, especially hauing so good a guide as my forenamed Author, to tread out the way before mee. Wherefore supposing as a ground, these Authors to much differing about the measure of the earth, to haue beene in some sort led by reason. The differences must needs arise out of one of these causes: either the error or negligence of the obseruers, in trusting too much to others relations without any farther search, or else the defect in the Mathematicall grounds out of which they deriued their demonstration; or the diuersity of measures vsed in this worke: or finally, from the misapplication of these measures to the distances; whence may arise some error out of the experimental measuring of places in the earth. In the first place it may perhaps be doubted whether *Aristotle* defining the measure of the Earth to bee 400000 furlongs, were not deceaued by relations: for as much as hee auoucheth it; from the Mathematicians of his times, whose authority and credit for ought wee know, deserues as well to bee forgotten as their names. But this answer might seeme too sharp in the other: for as much as wee find them registred for Masters in their science, and such as could not easily bee cosened by others impostures. Neither can wee imagine the second to bee any cause of their error for the same reason: because the wayes these Mathematicians vsed in finding out the circuit of the earth, are by writers of good credit commended to posterity, as warrantably grounded on certaine demonstrations, being no other then what wee haue shewed before, which admit of no Paralogisme: In the third place wee ought to examine whether the diuersity of opinion concerning this matter proceeded from diuersity of the measures which were vsed in this worke. *Nonnius* and *Prætorius* would needs perswade, that the Furlongs whereby they measured the earth were not the same: *Maurolycus* and *Xilander* talke of diuerse kindes of paces: *Maurolycus* labours to reconcile both, but without effect. First whereas they would haue diuerse kinde of paces, it cannot be denied: but in the meane time we cannot learne that the *Greeks* euer measured their Furlongs by Paces, but either by *Feet*, or *Faddomes*. A Faddome which the *Greeks* call *ᾠστία* is the measure

measure of the extension of the hands together with the breast betwixt, containing six feet: which is a kinde of measuring well knowne vnto our Mariners, in sounding the depth of the Sea. This measure notwithstanding is by many translated a Pace: by what reason, let any man iudge. *Xilander* in translating *Strabo* renders it an Ell: Secondly for a Furlong it containes according to *Herodotus* an ancient *Grecian* writer 600 Feet: which is also testified by *Suidas*, being much later. A Furlong containes 100 Faddomes; euery Faddome foure Cubits. A Cubit, according to *Heron*, a Foot and halfe, or 24 Digits. Now for the variety of Furlongs, it is true that *Censorinus* makes three kinds. For either it is called the *Italian* consisting of 625 Feet, which is of most regard in measuring the Earth; or the *Olympian* of 600 Feet: or the *Pythian* containing 1000 Feet. But to let passe this latter, we shall finde by serious consideration, that the *Italian* and *Olympian* Furlongs differ only in name, and are indeed the same. For the *Italian* containing 625 *Roman* Feet (according to *Pliny* in his second booke) is equall to the *Olympian*, hauing 600 *Grecian* Feet. For a Foot with the *Grecians* exceeds the *Roman* Foot by a twenty fourth part: as much as is the difference betwixt 600 and 625. Hence wee see how little certainty can bee expected of such as goe about to reconcile these opinions out of the various vse and acception of the measures. The most probable assertion then is, that the error was grounded on this, that the distances of places, mentioned by the foresaid Authors, were not by themselves exactly measured, but taken vp vpon trust on the relation of travellers, wherein they might easily bee mistaken. For instance wee will take *Eratosthenes* and *Possidonius*, as of greatest credit, who are notwithstanding taxed for many errors in their experimentall obseruations: whereas it is cleere that *Ptolomy* grounded his opinion on the distances of the places, exactly measured, as is witnessed by his designation of the Latitude of the earth so farre as it was discovered and knowne. *Eratosthenes*, for mistaking in the measure of distances, is much taxed by *Hyparchus*, as we find in *Strabo*: For betwixt *Alexandria* and *Carthage*, hee reckons aboue 13 thousand furlongs, whereas by a more diligent enquiry

there are found to bee but 9 thousand. Likewise *Possidonius* is knowne to bee mistaken, in that hee made the Distance betwixt *Rhodes* and *Alexandria* to bee 3000 Furlongs, whereas out of the relation of Marriners, some haue made it 4000, some 3000, as it is witnessed by *Eratosthenes* in *Strabo*; who notwithstanding, sayes that hee found by Instruments that it was not about 3750; and *Strabo* wou'd haue it somewhat lesse, as 2640. *Manurolencus*, going about to defend *Possidonius* against *Ptolomy*, brings nothing but triuious reasons vnworthy so good an author. Out of all which hath beene spoken our former Corollary will bee manifest, that the diuersity of opinions concerning the circumference of the Earth, arose from the experimentall mistake in the distances of places, where they trusted to other mens relations, rather then their owne knowledge.

6 The *Diameter* is a right line passing by the Center of the Earth from one side to the other, and measuring the thicknesse of it: the inuention of which depends on these Rules.

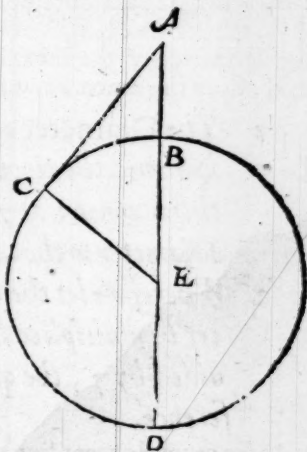
1 As 22 is to 7 so is the circumference of a circle to the *Diameter*: wherefore the circumference of the Earth multiplied by 7, and divided by 22 will produce the *Diameter*.

The exact proportion betwixt the *Circumferences* of a circle, & the *Diameter* being the ground of the *Quadrature* of a circle, is a matter which hath set a work the greatest wits of the world: hauing notwithstanding as yet by no man been brought to discovery, in so much as *Pisiscus*, and other good Mathematicians, might well doubt whether euer it would come to light. Neuertheless, where exactnesse cannot bee found, wee must come as neere as we can. The neereest proportion in numbers which any could yet light on, is as 22 to 7, which in so great and massie a body, as the Earth may passe without any sensible or explicable error. Supposing then out of our precedent Suppositions the whole

whole circuit of the earth to bee 21600 *Italian*-miles (which is the common opinion now receaued) I multiply according to the golden Rule 21600 by 7, whence will arise 151200, which being diuided by 22 the Quotient will render 6872 $\frac{1}{8}$ which is the Diameter or thickenesse of the Earth: some lesse curious are content to take only the third part of the circumference for the Diameter, which will be 7200, which account is lesse exact, yet sufficient for an ordinary Cosmographer: for as much as 328 miles, which is the difference, is of no great moment in the measure of the whole Earth.

- 2 By the knowne height of some mountaine without the knowledge of the circumference of the Earth, the Diameter may be found out.

This is a way inuented by *Maurolycus*, which proceeds in a contrary manner to the former: because the former by the circumference first supposed to be known, shewes vs a way to find out a Diameter: but this, first seeks out the Diameter, by which wee may finde out the circumference: the practise is in this manner. Let the circuit of the Earth be conceaued to be B C D (as we see in this Figure) in which let there be chosen an high Mountain whose Altitude A B may bee knowne by the rules of measuring altitudes: then from the Mountaines top A, by the rules of measuring longitudes must the whole space of Sea or Land bee measured so far as it can be seene: so that the visuall Beame A C, may touch the Superficies of the Earth in C: let the space the which is seene in the Earth be B C, which although in it selfe it bee crooked and not plaine, yet can it not sensibly differ from a Plaine, for as much as the Arch B C, is ex-



ordinarily little, if compared with the whole Earth. These grounds thus laid, we must proceed by a Geometrical manner of argumentation in this sort. Here are to be obserued foure right lines: whereof the first is AB , the height of the mountaine obserued: the second is the visuall Ray AC : the third AD consisting of the height of the mountaine, and the Diameter of the Earth. The fourth BC , the distance which is scene: for (as we haue shewed) it may without sensible error be taken for a right line. Now for as much as AB, BC are knowne, their Quadrates by the 47 proposition of the first of *Euclide*, will also be knowne, which being equall to the square of AC , the square of the right line AC will likewise be knowne. But the square of the right line AC , sith it toucheth the circle, will be equall to a Right Angle Figure contained vnder DA, AB , wherefore the right angle so conceaued will be knowne. But AB is the knowne height of the mountaine, wherefore the right line AD will easily be knowne; if we diuide the knowne right Angle contained vnder AB, AD : by the right line AB : for the Quotient will giue the right line AD ; from which if we subduct AB , the knowne height of the mountaine: then will remaine the Diameter of the Earth BD , which was here to be performed: from this inuention will arise this Corollary.

1. *The Diameter of the Earth first supposed to be knowne, the circumference may be found out in this manner: as 7 is in proportion to 22, so is the Diameter to the Circumference.*
2. *Wherefore let the knowne number of the Diameter be multiplied by 22, and the Product be diuided by 7, the quotient will giue the Circumference.*

As for example according to our former instance: Let vs suppose the Diameter of the Earth to be 6872 $\frac{8}{11}$ this number being multiplied by 22, will produce 15120, which product diuided

diuided by 7, wee shall finde in the Quotient 21600, which is the circumference of the Earth.

7 The compound dimensions, according to which the Spheare of the Earth is proposed to bee measured, are either the *Superficies* or the *Solidity*.

8 The Superficies is againe twofold, either *Plaine* or *Conuexe*: the *Plaine* is the space included in the Perimeter.

9 The plaine Superficies may be found out two wayes: either by the *Circumference*, or the *Diameter*: both which wayes taught in these Rules.

1 If the whole circumference bee multiplied in it selfe, and the product bee diuided by $12\frac{1}{2}$ the quotient will shew the Superficies included in the circle.

As in the former example wee will take the Circumference of the Earth to be 21600 *Ital* an-miles: let this number be multiplied in it selfe, and the product thereof diuided by $12\frac{1}{2}$, the Quotient will amount vnto 9278180, which is the plaine superficies of the Earth.

2 If the Semi-Diameter of a circle be multiplied by the halfe part of the Circumference: there will arise the measure of the Plaine Superficies contained in the Circumference.

The reason hereof is shewed by *Clavius* in his Tract de *Isoperimetris Proposit. 4.* where is demonstrated, that a Right Angle

figure comprehended of the *Semi-Diameter* of any circle, and the halfe of the Circumference will be equal to the Circle it selfe, of whose parts it is comprehended.

10 So much concerning the *Plaine Superficies*: the knowledge and inuention of the *Conuexe*, may bee performed two wayes: either by the *Diameter* and *Circumference*; or else by the *Space* contained within the *Circumference*, according to these Propositions.

1 *If the Circumference and Diameter be multiplied the one into the other, the product will shew the number of square miles in the face of the Terrestrial Globe.*

As for example, let the Diameter of the Earth containing according to the common account 80111 $\frac{2}{3}$ furlongs, bee multiplied by the whole circumference, which is 252000, there will arise the *Conuexe Superficies* of the whole earthly Spheare which is 20205818181 $\frac{2}{3}$.

2 *If the Space contained in the greatest circle in the Spheare bee multiplied by 4, there will bee produced the whole conuexe Superficies of the Spheare.*

How to finde out the space or plaine Superficies, is a matter taught before: which being once found is easily multiplied by 4, and so will giue vs the number sought.

11 The last and greatest compound Dimension, according to which the Earth is measured, is the *Solidity*, consisting of *Length*,
Bredth,

Bredth, and *Height*, or *Thicknesse*: This may bee found out two wayes either by the *Diameter*, and *Conuexe Superficies*, first supposed to be known: or by the knowledge of a great circle without supposing the *Superficies* to be first knowne: both wayes shall bee expressed in these Propositions.

- 1 If the *Semidiameter* of the *Spheare* be multiplied into the third part of the *Conuex Superficies* of the said *Spheare*, there will arise the whole *Solidity* of the *Earth*.

This is demonstrated by *Geometricians*: For a solide Rectangle comprehended of the *Semidiameter* of the *Spheare*, and the third part of the *Conuex Superficies* of it, will be equall to the *Spheare* it selfe. As for example, if the *Semidiameter* of the earth containing 40090 $\frac{1}{11}$ Furlongs bee multiplied by the third part of the *Conuex Superficies* containing, to wit, 67352727 $\frac{3}{11}$, there will arise the solidity of the earth, which will containe 270023:06611570 $\frac{3}{11}$ Cubicke Furlongs. That is the solidity of the earth will comprehend so many Cubes, containing euery side so many Furlongs, as there are vnities in the said number: For the *Area* or spaces comprehended of Solide figures are measured by the Cubes of those lines, by whose squares the *Conuexe Superficies* of those lines are measured.

- 2 If the greatest circle bee multiplied by $\frac{2}{3}$ of the whole *Diameter*: the product will shew the *Solidity* of the *Spheare*.

This way is also demonstrated by *Clavius* in the same tract of measuring Magnitudes. It may Arithmetically bee deduced in this sort. If any *Spheare* whatsoever hath a *Diameter* of 14 Palmes, and should bee multiplied by 3 $\frac{1}{2}$, the circumference of
the

the greatest circle containing it will be found to be 44; whose halfe being 22, if it be multiplied into the Semidiameter 7, there will arise the Superficies of the greatest circle 154, which number if wee multiply by two third parts of the Diameter: that is by 9 $\frac{1}{3}$ there will bee produced the solidity of the said Spheare, to wit, consisting of 1437 $\frac{1}{3}$ Cubicke palmes. In the like sort may wee worke by miles or furlongs in measuring the whole terrestriall Globe, which is a more conuenient measure for the masse Globe of the Earth.

C H A P. IX.

Of the Zones, Climates, and Parallels.

- 1 **O**F the Measure of the Earth we haue treated in our former Chapter. In the next place wee must speake of the Distinction of the Terrestriall Spheare, which is either in regard of *Spaces* or *Distances*.
- 2 Spaces are portions in the Spheare bounded by the Parallell circles: such as are the *Zones*, *Climats*, and *Parallels*.
- 3 These are againe considered two wayes; either in themselves, or else in their Adiuncts or Inhabitants belonging to them.
- 4 A *Zone* is a space included betwixt two lesser

lesser and named circles; or else betwixt a lesser circle and the Pole of the world.

The spaces into which the Terrestriall Spheare is diuided, are either Greater or Lesser. The Greater is a Hemisphere which ariseth out of one only circle by it selfe; without the Combination of more. Such are chiefly of three sorts. The first is made by the Equatour: which diuides the whole Globe into the north and the South Hemisphere. The second is of the Meridian, whose office it is to part the Earth into the Easterne and Westerne Hemispheres: The third of the Horizon, which diuides the Spheare into the vpper and lower halfe: But these parts arising (as I said) out of one only circle, are handled before with the circles themselves. In this place wee are to speake of such parts, as arise out of the Combination and respect of circles one with another. Such as are the Zones, Climats, and Parallels. A Zone signifies as much as a girdle or band: because by it the spaces in the Earth are (as it were) with larger bands compassed about. The *Grecians* haue sometimes given this name Zone to the Orbs of the Planets, as *Theon, Alexandrinus* in his Comment on *Aratus*, in these words, Ἐξαι δὲ ὁ ὕψους ἔξωτος ἐν ἐπιφανείᾳ τοῦ Ζωδιακοῦ αἶθρ, τὸν μὲν ἀπὸ τοῦ ἐξαι δὲ Κεῖν: ὃ δὲ δὲ τοῦτον δὲ Ζώνη. There are (saith he) in the Heauens seauen Zones not conterminat with the Zodiacke, whereof the first is possessed by Saturne, the second by Jupiter, &c. But this acception of the name is far off from our purpose. The name, Zone, as it is with vs in vse, is by the Latine Poëts rendred sometimes *Facia*, sometimes *Plaga*: both signifying one and the selfe-same thing: which is as much as a space comprehended within two Named and lesser Parallels: or at least betwixt such a Parallell and the Pole it selfe: because, as wee shall shew hereafter Zones are of two sorts: These Zones are in number fiae; which diuision hath beene familiar with our Latine Poëts, as may appeare by these verses of *Virgil*.

*Quinq; tenent cœlum Zona, quarum una cornusco
Semper Sole rubens, & torrida semper ab igne:
Quam circum extrema dextrâ laudâq; trahuntur.*

Carule.

*Carule à glacie concreta, atq; imbribus aëris.
 Has inter, Mediamq; dua Mortalibus agris
 Munere concessa Diuum, &c.*

Fiue Zones ingirt the Skies; whereof one fries
 With fiery Sun-beames, and all scorched lies.
 'Bout which the farthest off on either hand,
 The blew-eyed Ice and brackish showres command.

'Twixt these two and the midst the Gods doe giue
 A wholsome place for wretched man to liue.
 Which description of *Virgil* little differs from that wee finde in
Ouid, in these Verses.

*---Dua dextrâ cælum totidemq; sinistrâ
 Parte secant Zona: quinta est ardentior illis:
 Sic onus inclusum numero distinxit eodem
 Cura Dei, totidemq; Plaga tellure premuntur.
 Quarum qua Media est non est habitabilis æstu:
 Nix regit, alta duas: totidem inter utramq; locauit.
 Temperiemq; dedit mista cum Frigore Flamma.*

Two Girdles on the right hand, on the left
 As many cut the Skies: more hot's the fift.
 So God diuiding with an equall hand,
 Into so many parcels cuts the land.
 The midst through heat affords no dwellers Ease:
 The deepe snow wraps vp two: but betwixt these
 And the other Regions, are two places set,
 Where frosts are mixt with fires, and cold with heat.

But because this enumeration and description of the Zones set
 downe by the Poëts, seemes too popular and generall, wee will
 more specially diuide them according to the methode of our
 times in this manner.

- 5 The Zones are either *Vntemperate*, or *Temperate*:
 the *Vntemperate* are againe twofold either
 cold or hot.
- 6 The *Intemperate* hot Zone is the space con-
 tained

tained betwixt the two *Tropicke* circles of *Cancer* and *Capricorne*.

How vnaptly these names of *Temperate* & *Untemperate* agree to the Zones, considered in their owne nature, wee shall speake in our second part: yet because I thought it vsfit to vse other tearmes then the Ancients, I will not coine new names. This Zone, or space included betwixt the two Tropicks, circumscribes within it two great circles, whereof the one is the Equatour running iust in the midft, neither inclining to the North or South: The other is the *Eclipsicke* obliquely crossing it and meeting the two Tropicks twice in a yeere, in the *Spring* and *Autumne*. The extent or breadth of this Zone then is equall to the distance betwixt these two Tropicks, to wit, 47 degrees, which make 2820 miles: because from the Equatour to either *Tropicke* we account 23 degrees, which added and resolved into miles, will make the said summe: within the compasse of this Zone is situate the greatest part of *Africke*, especially that of the *Abyssines* (which common opinion with little probability, would haue to bee the Empire of *Prester John*) also many Islands as *Iaua*, *Summatra*, *Taprobana*, besides a great part of the South of *America* called *Pernana*: It was imagined by the Ancients, as *Aristotle*, *Pliny*, *Ptolomy*, and many other Philosophers, Poets, and Diuines, that this Zone through extreame heat was altogether vnhabitable: for which cause they called it *Intemperate*: The reason of this coniecture was drawne from the situation of this part in regard of that of the heauens. For lying in the middle part of the world, the Sunne must of necessity cast his rayes perpendicular, that is to say at Right Angles. Now according to the grounds of Peripateticke Philosophy the Idol of this age, the heat deriued from the Sunne, ariseth from the reflexion of the Sunne-beames against the surface of the Earth. Wherefore the heat was there coniectured to bee greatest, where the reflexion was found to bee greatest. But the greatest reflexion, according to all Mathematicians, must be in this *Torrid Zone*, where the Sunne darts forth his Rayes at right Angles, which reflect backe vpon themselves. Which

false

false coniecture was a long time continued by the exuberant descriptions of Poëts, and defect of Nauigation: hauing as yet scarce passed her infancy. But how farre these furrises come short of truth, wee shall declare in our second part, to which wee haue referued those Physicall and Historicall discourses concerning the qualities and properties of the Earth.

- 7 The Intemperat cold Zones are those which are included betwixt the Polar circles and the Poles: whereof the one is *Northerne*, contained in the *Arcticke* circle, the other *Southerne* in the *Antarcticke*.

These two Zones are not made out of the combination of two circles, as the former: but by one circle with relation to the Pole. The greatnesse and extent of this Zone is about 23 degrees and a halfe: which resolued into *Italian*-miles will produce 1380. The *Northerne* cold Zone contains in it *Groenland*, *Fineland*, and diuerse other *Northerne* Regions, whereof some are partly discouered, and set out in our ordinary Maps, other some not yet detected. For the other Zone vnder the *Antarcticke* Pole, it consists of the same greatnesse, as wee know by the constitution of the Globe, hauing other such accidents correspondent as the *Northerne*, so farre forth as they respect the Heauens. For other matters, they lye hid in the vast Gulph of obscurity, this port hauing neuer yet (for ought I know) exposed her selfe to the discouery of the Christian world. Whether these two Zones be without habitation, by reason of intemperate cold, as the other hath been thought by reason of too much heat, wee shall in due place examine.

- 8 The Temperate Zone is the space contained betwixt the *Tropicke* & the *Polar* circle: whereof the one is *Northerne* contained betwixt the *Tropicke* of *Cancer* and the *Arcticke* circle: the other

other Southerne comprehended betwixt the Tropicke of *Capricorne* and the *Antarctique* circle.

Why these Zones are tearmed Temperate, diuerse reasons are alleaged. 1 Because the Sun-beames here are cast obliquely on the surface of the earth, and by consequence cannot produce so much heat, as in those places where they are darted perpendicularly, if wee only consider the constitution and site of the heauens: For as we shall hereafter proue, this may sometimes be altered by the disposition of some particular place. 2 It may be called the Temperate Zone, because it seemes mixt of both extreames partaking in some measure the both qualities of heat and cold: the one from the Torrid, the other from the Frigid Zones. 3 Because in these Zones the distances betwixt Summer and Winter are very remarkable, hauing a middle difference of time betwixt them, as compounded of both extreames. These temperate Zones included betwixt the Tropicks and the Polar circles are twofold as the circles: The northerne temperate Zone comprehended of the Tropicke of *Cancer* and the *Arctique* circle, contains in it the vpper and higher part of *Africke*, stretching euen to the mountaine *Atlas*: Moreouer in it is placed all *Europe*, euen to the Northerne Islands in the *Arctique* Zone, and a great part also of *Asia*: the other temperate Zone lying towards the South, is not so well knowne being farre distant from our habitation: and awaiting as yet the farther industry of our *English* and *Dutch* Nauigators. The bredth of this Zone, as the other contains about 43 degrees which is the distance betwixt the Tropicke and the Polar circle, which multiplied by 60, will be resolued into 2580 Italian-miles.

1 The *Torrid Zone* is the greatest of all: next are the two *Temperate Zones*: the cold Zones the least of all.

The *Torrid Zone* is found to be greatest as well in regard of longitude

longitude as latitude, and is diuided by the Equatour into two halves: the next are the Temperate; but the two cold Zones howsoeuer equall in Diameter to the Torrid, are notwithstanding least of all: where is to bee noted that euery Zone is of the same latitude from North to South, beginne where we will, because it is contained betwixt two equidistant circles: but all inioy not the same longitude from East to West, For the parts of euery Zone by how much neerer they are to the Equatour so much greater longitude will they haue: by how much neerer the Poles they are, so much the lesse longitude: for as much as the Parallels towards the Poles grow alwayes lesser and lesser. The inuention of the quantity of the Zones before mentioned, may briefly thus bee performed. The latitude of the torrid Zone is so much as the distance betwixt the Tropickes, which is Astronomically grounded on the greatest declination of the Sunne being doubled: This declination being by *Clavius* and others found to be 23 degrees 30 scrup. which being doubled will produce 47: which againe multiplied by 60 and resolved into miles, will amount to 2820: though the odde scruples of many Authors are neglected. The latitude of the cold Zones is also drawne from the greatest declination of the Sunne: For the distance of the Pole circles from the Pole it selfe is iust so much as the declination of the Eclipticke from the Equatour, to wit, of 23 degrees 30 scrup. to which answer according to the former Rule 1420 *Italian*-miles. The inuention of the latitude of the temperate Zones depends from the subtraction of the distance of the Poles of the Eclipticke, from the Equatour: that is from the greatest declination of the Sunne being doubled from the whole quadrant: in which subduction the residue will be 43, to which will answer 2580 *Italian*-miles.

- 1 *The Zone wherein any place is seated may bee knowne either by the Globe or Geographickall Table, or else by the Tables of Latitude.*

By the Globe or vniuersall Mappe wee may know it by the diligent

diligent obseruation of the foure equidistant circles. For if wee find it betwixt the two Tropicks, we may without doubt, thinke it to be in the Torrid Zone: If betwixt the Tropicke circle and the Polar, it will be in the Temperate. If betwixt the Polar circle and the Pole it selfe, it must bee in the cold Zone. By the Tables of Latitude it may be found this way: Seeke the latitude of the places giuen in the Table, which if it bee lesse then 23 degrees 30 scruples, the place is in the Torrid Zone. If precisely it bee so much in the Northerne Hemisphære, the place assigned is vnder the *Tropicke of Cancer*, which is the bound betwixt the *Torrid* and the beginning of the Northerne *Temperate* Zone: But if it be in the Southerne Hemisphære, it will be vnder the *Tropicke of Capricorne*: which ends the *Torrid* Zone, and begins the South *Temperate* Zone: Euery place hauing more Latitude then 23 degrees 30 scruples, yet lesse then 66 degrees 30 Minutes, is seated in the Temperate Zone, either Northerne or Southerne, as the places are in the Hemisphære. If the place be precisely of 66 Degrees 30 minutes, it will be iustly found to be vnder the Polar circle, either *Arcticke* or *Antarcticke*. Finally euery place whose Latitude exceeds the number of 66 degrees 30 minutes, is seated in the cold Zone either Southerne or Northerne. If it reach iust to 90 degrees, it will bee iust vnder the Pole it selfe.

- 9 Of the distinction of the Terrestriall Spheare by Zones we haue spoken: we must in the next place deliuer the Distinction of the earth according to Climates.
- 10 A *Climate* is a space of the Earth contained betwixt two *Parallels* distant from the *Equatour* towards either Pole.

Climates are so called because of their *Declaration* from *Equatour*; for as much as they are to bee accounted as so many scales of ascents to or from the *Equatour*. Some haue defined it from the vse which is chiefly to distinguish the longest

time of the Artificiall day : because at the point of euery climate truly taken, the longest day is varied halfe an houre : although this account agree not altogether with *Ptolomie*, and the ancient Geographers before him, as wee shall shew hereafter. This distinction of the Terrestriall Spheare into *Climates* is somewhat a more subtile distinction then the former by Zones; for as much as that is made by the combination of such Parallels as are principally named and of chiefe note, as the Tropicks and Polar circles. But this indifferently respects all without difference. This first beginning and measure, as well of this as all other measures of the earth is the Equatour, for that which is most perfect and absolute in euery kinde ought to be the measure of all other. But yet wee must vnderstand, that although wee beginne our account of the Climats from the Equatour; yet the Equatour it selfe makes no Climate, but only the Parallels which are thereunto correspondent. For as it is before shewed, vnder the Equatour it selfe, the artificiall dayes are all equall in length, containing only twelue houres : wherefore beginning from the Equatour betwixt that and the third Parallell, wee count the first climate : from the third to the sixt, the second Climate : and so all the rest, making the number of the *Climates* double to the number of the Parallels; so that one and the selfe same Parallell, which is the end, and bound of one Climate is the beginning of the next; whence wee see that to the constitution of euery Climate three Parallels concur, whereof two are extreame, comprehending the bredth of the said Climate, and one diuiding it iust in the midst. A Parallell therefore differs from a Climate, as a part from the whole, being one circle correspondent to the Equatour, whereas a Climate is a space contained in three Parallels. Secondly, as a Parallell is conceaued to adde to the artificiall day one quarter or fourth part of an houre; so a Climate makes halfe an houre; so that by how much any Climate is distant from the Equatour, by so many halfe houres the longest day of that Climate goes beyond the longest day of the place vnder the Equatour. These *Climates* therefore cannot bee all of one equall quantity; because the Equatour is a greater circle, and
compre-

comprehends the greatest space in the Earth: so that it must needs follow that these Climates neere the Equatour being made by the combination of greater circles are greater then those neerer the Poles. But because all Climates are made by the combination of Parallels; wee are to vnderstand that there are three sort of Parallels to bee knowne in *Cosmographie*: The first are those which doe distinguish the latitude of places, taking their beginning from the Equatour; and are in an ordinary Globe of Mappe distinguished, sometimes by 10, sometimes by 15 degrees. The second kinde of Parallels are those that make the Zones, which are indeed some speciall named Parallels, as the Tropicks and the Polar circles: The third sort are called Artificiall Parallels; because they shew the distances of artificiall dayes and nights, which are commonly noted in the margent of a Geographickall Mappe, which last sort of Parallels are here chiefly to be vnderstood.

1 *The Zones and Climates agree in forme but differ in greatnesse, number and office.*

The Climates are so called (as we haue said) because they decline from the Equatour, and are spaces of the Earth containing two Parallels, in which the longest day is varied by halfe an houre. These agree with the Zones in some sort: for both of them are spread by the latitude of the Earth, and by Parallell circles compasse it about as so many girdles: Neuerthelesse they differ one from the other. 1. In *Greatnesse*, because the Zones are greater, the Climates lesser spaces in the Earth. 2. In *Number*, because there are only fve Zones, but many more climates. 3. In *Office*, use and effect, because the Zones are to distinguish the mutation of the quality of the aire and shaddowes according to diuerse Regions of the Earth: but the Climates are vsed to shew the greatest differences of houres in the day: to shew the variation of the rising and setting of the starres, for places vnder the same Climate haue the same quantity of dayes and nights, the same rising and setting of the starres, whereas places seated vnder diuerse climats haue a great variation in the dayes and nights, and a diuerse rising and setting of

the stars: for as often as the longest or Solstitiall day of one place, differs from the longest day of another by the space of halfe an houre, a new Climate is placed: wherefore vnder the Equatour or middle part of the earth the dayes are alwayes equall, to wit, of 12 houres: which beginning from the Equatour, if wee approach towards either Pole, so far as the greatest artificiall day amounts to 12 $\frac{1}{2}$, we may assure our selues that wee are come to the first Climate: and so forward still the greatest day of our Climate will by so much exceed the greatest day of the other. As the Climates differ one from the other by halfe houres, so the Parallels by quarters, as we haue shewed: and shall more fully explaine in this Chapter.

2 *The Climates compared one with the other, are not all of the same greatnesse.*

Although the Climates are placed according to equall increase of dayes and nights, yet suffer they a great inequality: For no climate is equall to another in the same Hemisphere, but are still greater then other, by how much neerer they are to the Equinoctiall circle; for the latitude of the first Climate is reckned to be about 8 degrees, which make 480 *Italian*-miles: but of the last not so many minutes as quarters of miles.

11 In Terrestriall Climates, two things are to be vnderstood; 1 *The Inuention*: 2 *The Distinction*. The Inuention teacheth the manner how to find out in what Climate any place lieth. The finding out of any climate depends vpon the obseruation of the length of the day; for the length of the day being once known, the Climate will also bee found out by this Rule.

1 *Double the houres about 12, and the Product will shew the Climate.*

The

The reason of this rule is intimated before; to wit, that the climates are distinguished the one from the other by the space of halfe an houre of the longest day: Now the dayes vnder the equatour are alwayes equall, containing 12 houres in length: from which towards the Pole they are increased by degrees: wherefore the number of the Climates must needs bee double to the number of houres aboue 12: as for example, if I should find out in what Climate *England* is situated: I find the length of the longest day to be about 18 houres, which is six houres more then 12; this I double, and it will be 12; whence I collect, that *England* is situated vnder the 12 Climate: A more compendious way of finding out the Climate of any place, is by a certaine Table, wherein against euery Elevation of the Pole is set the iust Climate: which Table we shall insert hereafter. Here must bee noted that this rule which wee haue taught is to bee vnderstood of the Climates as they are absolute in nature, and not of *Ptolomies* Climates: If any man would finde out the Climates of *Ptolomie*, hee must first cast away three quarters of an houre, which is 45 minutes; because his Climates, as wee shall shew, beginne not immediatly from the Equatour, but from the latitude of 12 degrees.

12 Thus much for the *Inuention*: the *Distinction* of Climates is *Northerne* and *Southerne* Climates: both these againe are of two sorts, either proper or improper.

13 The proper Climates are those which are placed between the Equatour and the point neere the Polar circle: The improper are those from the Polar circle to the Pole it selfe.

Wee must vnderstand that the climates are considered two manner of wayes, 1 Absolutely in respect of the whole *Terrestrial* Spheare. 2 Comparatiuely, in respect of the knowne ha-

habitable part of the Earth: According to the latter consideration the ancient Geographers haue otherwise distinguished the Climates then the new writers: whence ariseth a great difference and confusion amongst them, in defining the number of the climates. For sometime they will haue a new climat put whensoever the day increaseth a quarter of an houre: sometimes at halfe an houre, sometimes at difference of an whole houre or day. But the doubt is easily answered, and reconciled by our former distinction; for whereas they put the difference of climates to be halfe an houre, it is to be vnderstood of these which are proper climates betwixt the Equatour and the Polar circle, for it is certaine that beyond this circle the artificiall day increaseth, not only by houres, but by dayes, weeks, months; so that another account must bee made of such climats then of the former. But it hath been generally taken for those climates of the Ancients: now the distinction of climates amongst the Ancients is of two sorts. The first was of the Geographers before *Ptolomy*, who placed the vttermost bound Northward in the 25th degree of Latitude or Eleuation, and so made only seuen climates. These 7 climates were all vnderstood to bee in the habitable parts wherein they were marked and designed out vnto vs by names taken from *Citties*, *Mountaines*, *Regions*, and such like remarkable places, where we are to conceaue that climate as neere as may bee guessed to runne through the middle of any such Region, whereof it taketh its name: But the better to vnderstand the Distinction of the climates, as well with the Ancients as Moderne Cosmographers, we will insert this following Theorem.

- I *In the placing and Number of the Climates and Parallels, there is a great diuersity betwixt the Ancient and Moderne Geographers.*

This hath been before mentioned: but for better distinction we haue reserued the handling of these differences to this proposition.

position, which may serue as a Carollary to the rest. First wee take it as granted that *Ptolomy* so appointed the Parallels (out of which the climates must arise) that he numbred 38 both wayes from the Equatour: to wit, 38 towards the South, and so many towards the North. These Parallels he so distinguished, that 24 he numbred by quarters of houres, foure by halfe houres, foure by whole houres, and six by whole months. Hence is it that Geographers say, that a new Parallell is to be placed sometimes whereas the longest day increaseth by a quarter of an houre; sometimes where it increaseth by a halfe, sometimes by a whole houre, sometimes by a whole moneth. The first is to be vnderstood of those 24 Parallels which were deliuered by the Ancients before *Ptolomy*. The second, third, and fourth of such as were vnkowne vnto those Ancients before *Ptolomy*. To reduce all into order we will set downe this distinction. The distinction of the Climats is either ancient or new. The Ancient was againe twofold: either former or latter. The former was that which was set downe before *Ptolomies* time, wherein there were assigned seuen Climates according to the common opinion (though *Mercator* grants but 5) These Authours placed their Northerne bound in the 25 degrees or eleuation: The later distinction was almost the same, but somewhat corrected by *Ptolomy*, who placed 9 Climates towards the North. The first passed by *Meroe* a City of *Ethiopia*, where the longest or Solstitiall day is 13 houres. The second by *Siene* in *Egypt*, where the longest day is $13\frac{1}{2}$: The third by *Alexandria* in *Egypt*, where the longest day is 14 houres. The 4th by the Island of *Rhodes*, where the longest day is of $14\frac{1}{2}$. The fift by *Rome*, where they haue the length of the longest day 15 houres. The sixt by *Pontus*, where the longest day is $15\frac{1}{2}$ houres. The seauenth by the mouth of *Boristhenes* where the longest day is of 16 houres. Neuerthelesse some haue drawne the 6 Climate by *Boristhenes* in *Sarmatia*, and the seauenth by the *Riphean* mountaines. *Ptolomy* to this number addes two more, and so reckons them that the 8 should passe by the *Riphean* mountaines, and the 9 by *Denmarke* where the day at longest is 17 houres. To these Northerne Climats they

opposed so many towards the South, which they called Anticlimates. These as it should seeme in *Ptolomies* time were imaginary altogether, because few or no places were discovered at that time beyond the Line. But to leave *Ptolomy* and his old Authors, and examine the industry of later Geographers, wee shall finde the Distinction of the Climates to bee twofold; either vnperfect wherein they numbred onely 19 Climates; or perfect, wherein they accounted 46 or 48, of which 23 or 24 were Northerne, and the other on the opposite part, to wit, in the South. The perfect distinction of the Climates is againe (as later writers speake) either certaine or vncertaine. The certaine they call that wherein the Climates are distinguished and ranged from the Equatour to the Polar circle: For sitthens the Northerne Regions are now discovered beyond 70 degrees of the *Elevation* of the Pole, and a Climate is defined to bee a space comprehended betwixt three Parallels in the habitable Earth: wherein the length of the longest day is increased by halfe an houre; Therefore it must needs be, that from the Equatour to that habitable part of the Earth, wherein the longest day is 24 houres (which is not farre from the Pole-circle) there should be placed 24 Climates. The vncertaine distinction they call that which is betwixt the Polar circle, and the Pole it selfe, which may bee termed *Improper*; because in these Climates the day is not increased by halfe houres, as in the former, but first by whole *Dayer*, then by *Weekes*, and last of all by whole *Moneths*: In so much that vnder the Pole it selfe they haue 6 Moneths perpetuall day, and so long againe a continuall night. The *Parallels* wherof the Climates are made, were set downe by *Ptolomie* 38 (as wee haue said) but the later writers haue placed them so farre Northernly, that they reach to that tract wherein the Sunne tarries about the *Horizon* a whole 24 houres, and so haue numbred 23 or 24 towards the *North*, and so many towards the *South*. The cause of this diuersity is because some draw the first by the mouth of the *Redde-Sea*: others by *Meroe*: for the farther consideration of these climates corrected by later Geographers, they beginne their account from the Equatour it selfe, which in this case is the best rule of certainty.

certainty : because we hold that whole tract of Earth to bee habitable, as we shall proue in our second booke.

14 A Parallell is a space wherein the longest day is increased by a quarter of an houre.

Concerning the *Parallels*, little can be said more then wee have opened in the doctrine of the *Climats* : for (as we shewed) the one cannot be well vnderstood without the other : only to auoid ambiguity of speech, wee must consider that a Parallell may bee taken either for a *Line* or *Circle*, in which sense wee tooke it in the fift Chapter : where we diuided them into *Named* or *Namelesse* : or else for a space bounded by circles as wee here vnderstand it. The neglect of this distinction hath made some *Geographers* speake sometimes improperly. The Parallell is found out by this rule.

1 Let the number of the longest day about 12 be multiplied by 4, and the Product will shew the Parallell.

The reason is giuen before in the doctrine of the *Climates*, because the *Parallell* space, according to Latitude, is but halfe the *Climate* : so that as in finding out the climate for any place wee ought to double the houres of the longest day about 12 : so here wee ought to quadruple them, which is to multiply them by 4 : As for example at *Rome* we finde the longest day to be about 15, which exceeds 12 by 3 ; which being againe multiplied by 4, will produce 12, which is the Parallell for the place.

2 The Parallels nowhere diuide the *Climats* into two equall parts.

In the climates wee are to consider two things, either their latitude or bredth from North to South ; or their longitude or extent from East to West. In respect of the former wee may hardly without sensible error call the Parallell halfe the *Climate*, in regard the three lines whereof the climate consists, to wit, the middle and the two extreames, are not alwaies of like distance : but if we consider the extent of the Circumference as
it.

it stretcheth i selfe betwixt East and West, we must needes acknowledge much more: to wit, that of two *Parallels*, diuiding the same climate betwixt them, that that is manifestly the greatest which is next the *Equatour*, and that is the least which is neere to the *Pole*: because the *Circles* which comprehend their *Parallel* spaces, continually decrease towards the *Pole*: so that if we imagine two men to trauell round about the earth, the one in a *Parallel* neerer the *Equatour*, the other neerer the *Pole*, in the same space of time; it must needs follow that he should goe far faster which is neerer the *Equatour* then the other neerer the *Pole*: for howsoeuer *Columella* seemes to make a *Parallel* to haue in bredth 60 foot, and to intimate by consequence an equality of the *Parallels* amongst themselves, yet must this be vnderstood of *Parallels* which are neere one to the other neerer the *Equatour*, which comprehend a great space of land, and admit no sensible difference. Other matters which concerne the *Climates* and *Parallels*, shall be (God willing) vnfolded in our *Tables* in the next Chapter, when we haue spoken of the *Inhabitants*, and such other adiuncts appertaining, without the which this treatise will be vnperfect, depending for a great part on such circumstances as our method admits not in this place, but immediatly follow.

CHAP. X.

Of the distinction of the Inhabitants of the Terrestriall Spheare.

I H Auing hitherto treated of the distinction of spaces bounded by circles in the Terrestriall Globe, to wit, *Zones*, *Climates*, and

and *Parallels*; wee are now to treat of the Inhabitants; as such adiuncts as properly belong to such spaces; so farre as it concerns the constitution of the whole Spheare.

2 The distinction of the Inhabitants is twofold; either *Absolute* or *Comparative*: Absolute as they may be considered in themselves without any comparison of one with the other.

3 The former is againe twofold; either from the *Position* of the Spheare, or the differences of their *Sun-Shadows*: According to the position of the Spheare the Inhabitants may be said to haue either a *Right*, *Oblique*, or *Parallel* Spheare according to their *Horizons*.

What these three Spheares are, may appeare by that which we haue formerly spoken concerning the distinction of *Horizons* in the sixt Chapter of this Treatise, and therefore needs no farther repetition: we are in this place to treat of the severall accidents, and conditions of the Inhabitants. Out of the distinction of the threefold Spheare will arise 13 manners of habitation: which for more order sake, wee will reduce into certaine heads in this manner.

4 The people of a right Spheare are such as enjoy a right Horizon, whose proprieties shall be declared in this Theoreme.

The Inhabitants of a Right Spheare in respect of the heauens haue the same accidents.

These accidents are chiefly foure, 1 They enioy a perpetuall Equinoctiall; hauing their dayes and nights alwayes equall the one to the other: because the Sunne neuer swaruing from his *Eclipticke*, hath his course equally diuided by the *Horizon*. 2 With them all the starres equally set and rise; because all the *Parallels* wherein the starres make their Diurnall Revolution are equally cut by the *Horizon*. 3 To them the Sunne is twice in the yeere verticall; that is directly ouer their heads; and twice againe in the yeere Solstitiall: The former in the first degrees of *Aries* and *Libra*, the latter in the first degrees of *Cancer* and *Capricorne*: which diuerse propositions of the Sunne, some later Geographers haue termed foure Solstices: two higher and two lower. 4 Hence comes it to passe that they yeerely enioy two winters, and two Summers: likewise two springs and two Autumnes. Their Summer when the Sunne is to them verticall: their winter when it is seated in either of the Tropicks. Their Springs and Autumnes while the Sunne is passing through the middle spaces betwixt both.

5 The people inhabiting an *Oblique Spheare* are such whose *Horizon* is oblique. The proprieties belonging vnto them are either *Generall* or *Speciall*.

6 The *Generall* are such as agree to all those which inhabit an oblique Spheare.

1 *All the Inhabitants of an oblique Spheare agree in two proprieties.*

These two proprieties wherein they agree are these. 1 To all the Inhabitants without the Equatour vnder what *Parallell* fouer, the dayes are equall to the nights only twice in a yeere, to wit, either in the beginning of the Spring, or the beginning of
of

of the Autumne. At other times either the dayes increase above the nights as in the Summer, or grow lesser as in the winter.

2 To these inhabitants some stars are perpetually seene, as such which are neere the Pole to which they incline: some are neuer seene, as such as are farthest off from the said Pole: some rise and set, which are those which are in the middle space betwixt both; which are sometimes visible, and sometime lie hid.

7 The speciall Accidents of an Oblique Horizon, are such as agree to speciall places in the same Spheare.

1 *The Inhabitants of an Oblique Spheare of five sorts, inioying so many correspondent properties.*

The first sort are of those, whose Zenith is betwixt the *Equator* and one of the *Tropicke*s, euen vnto the 23-Degrees, 30. Scruples of eleuation of the Pole: In such a sort, towards the North betwixt the Line and the Tropicke of *Cancer*, are placed the inhabitants of *Zeilan*, the extreame part of the *East Indies*, *Hispaniola*, *Guinea*, *Nubia*, with some part of *Arabia felix*, and all other places betwixt the *Equatour* and the Tropicke of *Cancer* in the *Torride Zone*. Towards the South in the same Latitude, are placed the *Brasilians*, the *Perunians*, the *Iauans*, with many others. The Accidents which happen vnto these Nations are these, 1. They may see all the starres except a few which are neere the Pole. 2. Their dayes and nights are somewhat vnequall, so that their longest day, or longest night, is not alway of the same quantity. 3. Twice in the yeare they haue the Sunne-verticall, but without the *Equatour*. 4. They haue two Summers, and two Winters, but not equally tempered. 5. The length of their longest day reacheth to 13. $\frac{1}{2}$ houres.

The second sort are such as inhabite vnder the *Tropicke* it selfe, whose eleuation of the Pole is equal to the greatest declination.

clination of the Sunne, which is 23. degrees, 30 Scruples. Vnder the *Tropicke of Cancer* is placed a great part of *Arabia felix*, *East India*, the Southerne parts of *China*, the higher parts of *Egypt*, and *Siene*. Vnder the *Tropicke of Capricorne* are placed the people of *Monomotapa*, and *Madagascar*, with other places: The accidents belonging vnto them are these, 1. To them appeare all the starres comprehended in one of the circles, but none of the other. As for example, to those inhabiting the *Tropicke of Cancer*, the starres included within the *Articke Circle* alwayes appeare, but neuer those which are in the *Antarcticke*: likewise to those which dwell vnder the *Tropicke of Capricorne*, all the starres appeare which are contained within the *Antarcticke Circle*, but none of those included within the *Articke Circle*. 2. By how much neerer the Sunne approacheth to their Zenith or Verticall point, by so much are their dayes lengthened; and by how much farther it goes off, by so much are they shortned: so that they inioy then their longest day, when the Sunne directly passeth by their Zenith. 3. To them the Sunne is verticall but once in the yeere: to wit, to those vnder the *Tropicke of Cancer*, when the Sunne enters into the signe; as to the other when it toucheth the first Degree of *Capricorne*. 4. They haue but one Summer and one Winter throughout the yeere.

The third sort, are such inhabitants as dwell in one of the temperate Zones betwixt the *Tropicke* and the *Polar Circles* from 24. Degrees of eleuation, to 66. Degrees, 30. Scruples. Such inhabitants towards the North, are (as wee haue shewed) almost all the inhabitants of *Europe*, *Asia maior*, and part of *Africa*: as on the other side towards the South, the *Chylenses*, the farthermost *Africans*, and those that dwell neere the straits of *Magellane*. Their properties are chiefly these, 1. Many starres are by them alwayes scene, and many neuer appeare. 2. Their dayes notably differ in inequality. 3. The Sunne neuer arriues at their Zenith, but is alwayes on the South of those which inhabite betwixt the *Tropicke of Cancer*, and the *Articke Circle*, and alwayes on the North side of such as dwell in the opposite temperate Zone. 4. They haue in the yeere

yeere but one Summer and Winter, but by reason of the diversity of places much vnequall: for where the eleuation of the Pole is greater, the winter is much harder; but where it is lesse it is more temperate.

The fourth kinde of inhabitants, are those which reside vnder the Polar Circle, (which is their Zenith) where the temperate Zone endes, and the cold begins: where the eleuation of the Pole is beyond 66. Degrees 30. Minutes, in which Tract lies *Noua Zembla*, with many other Ilands not yet well discouered in the North: and perhaps as many more vnder the Antarticke Circle towards the South, lesse knowne than the other. The accidents belonging to them are these, 1. Those which inhabite vnder the Arcticke Circle, see all the starres included within the Tropicke of *Cancer*, but neuer those within the Tropicke of *Capricorne*: Likewise, those which liue vnder the Antarticke Circle, see all the starres within the Tropicke of *Capricorne*, but neuer those within the other Tropicke of *Cancer*. 2. Their longest day at Midsummer is 24. houres, their night then being but a moment: likewise their longest night, as at Mid-winter, is but 24. houres, their day passing not a moment. 3. The Center of the Sunne euery yeere twice toucheth at their Horizon. 4. The Sunne at Noonetide is alwayes on the South of those which dwell vnder the Arcticke Circle, except it bee in the Summer Tropicke, when it is the Mid-night, or Northerne point: likewise to those that are vnder the Antarticke Circle, the Sunne at noone is alwayes on the Northside, except vnder the Winter Tropicke. 5. They haue in the yeere one Winter and one Summer: but the Winter farre colder, and the Summer flacker then in the forenamed places.

The fift and last habitation, is of those which are included betwixt the Polar Circle, and the Pole it selfe, from 66. Degrees and 30. minutes of eleuation to 90. In which Tract, little is discouered Northward, and in the South climate nothing at all. The speciall Accidents appertaining to them are these, 1. With them a few starres are seene to set and rise. 2. They haue an *Equinoxe* the Sunne touching the first Degree

gree of *Aries* and *Libra*. 3. They of the North Zone haue more dayes about the middle of Summer, and more nights in the Winter: likewise, they of the South frozen Zone, the contrary. 4. They haue extreame cold Winters, and in stead of Summer, a small remission of cold. 5. The signes of the Zodiacke to them preposterously rise.

8 The inhabitants of a *Parallell Spheare* are discouered in this proposition.

1 *The inhabitants of a Parallell Spheare enioy but one kinde of habitation, in respect of the Heauens.*

A *Parallell Spheare*, I here accurately vnderstand for that position of the Globe, wherein the Pole of the world is precisely placed in the Zenith, or eleuated to 90. degrees of Altitude: because onely in such a site, the Equator and the Horizon agree in one, and lye parallell to all the rest of the *Parallell Circles*: which places, whether it bee at all capable of habitation by reason of cold, wee shall discourse hereafter in the second part: but out of supposition admitting a place of habitation, these accidents will happen. 1. The fixt stars which they see, are alwayes seene so, that with them there is no point of East or West; for the starres neuer rise nor set. But the Planets rise and set, but not by their diurnall, but proper motion. 2. They haue a continuall day of sixe moneths, and a night also as long, the Sunne rising continually in the first degree of *Aries*, and setting in the first of *Libra*. 3. The Sunne in the Equinoctiall points, for all the time that hee is about the Horizon (as all the other starres) is turned round about in manner of a wheele. 4. The Equatour serues in place of the Horizon, and the Equatour is euery where equidistant from the Pole. 5. They haue one Winter and one Summer, the former exceeding cold, the latter lesse warme then ours.

9 The second distinction of the inhabitants
of

of the earth is taken from their *Noone-shaddowes*.

The Sunne in diuers parts of the earth diuersly spreads his shaddow, because the *Gnomons* or *Opacous* bodies by which the shaddowes are made in the earth, are in diuers places diuersly opposed, or objected to the Sunne: for whereas the Sunne so runs in his *Eclipticke* Circle betwixt the two Poles, that though his passage be in an oblique Circle, yet he neuer comes so farre as the Poles themselves: it necessarily must be, that sometimes he should shoot forth his beames *perpendicularly*, as when it is in the verticall point of a place; sometimes *Obliquely*, as when he declines either one way or other from the verticall point; sometimes in *parallell* wise, for as much as in some places of the earth, the Sun cleauing as it were to the Horizon, casts out his beames *parallell* and *equidistant* to the plaine of the Horizon. The right or perpendicular beames of the Sunne, falling on the superficies of the earth at right Angles, are turned and reflected into themselves, and so make no shaddowes at all. But the oblique beames, in that they are not reflected into themselves, must of necessity produce shaddowes, yet in diuers manners; for those Sunne-beames which obliquely proiect themselves on the plaine of the earth, so as they come not from the Horizon it selfe, will make such kinde of shaddowes as shall proportionally agree with their *Gnomons*, or *Opacous* bodies, and such whose magnitude may in a manner be designed out, and certainly measured by the sight. But on the contrary part, the beames which are esteemed *parallell* to the plaine of the Horizon, finding no solide obstacle or let, shoot forth infinitely, making no Angles on the superficies of the earth, and can haue no proportion at all with their *Gnomons*, that the shaddow may be any way designed by our eyes. But here we are to consider, that the shaddowes chiefly to be considered, are the *Meridian* or *Noone-shaddowes*, which take their distinction from the diuers incidency of the beames, which the Sunne casts forth at noone. According to this manner.

10. The inhabitants of a place in respect of the shaddowes are either *Amphiscij*, *Heteroscij*, or *Periscij*. The *Amphiscij* are those, whose *Noone-shaddowes* (but at diuers times of the yeere*) are cast both wayes; that is to say, North and South.

Amphiscij signifies as much as people of a double shaddow: such are they which inhabite betwixt the Equatour and the Tropickes, where the eleuation of the Pole equals not 24. degrees: These men haue the Sunne twice euery yeere in their Zenith or verticall point, and then they make no shaddowes at all; and therefore they are called *Ascij*, or without shaddowes. But when the Sunne passeth from their verticall point towards the Northerne signes, then at noone it will cast the shaddow towards the Southerne coast: But contrarywise, coming from the Zenith toward the Southerne signes, the shaddow will bee darted toward the North, which is eident out of the *Opticke* principles; because the shaddow is alwayes found to be opposite in place to the *Sunne-beames*, the *Gnomon*, or darke body interposed.

11. The *Heteroscij* are those, whose *Noone-shaddowes* turne only one way, that is, either toward the North, or toward the South.

These Nations inhabite in a temperate Zone, betwixt the Tropicke and the Polar Circles, whereas such as dwell in the temperate toward the North, betwixt the Tropicke of *Cancer* and the Polar Circle *Arctike*, haue their noone-shaddowes cast Northward. But those on the other side of the Equatour, dwelling betwixt the Tropicke of *Capricorne*, and the *Antarctike* Circle, cast their shaddowes Southward: Of the former

mer sort are *Grecians, Italians, French, Spaniards, Germans, Pontonians, Suedians, Danes, English*, and the rest inhabiting our temperate Zone: which gaue occasion of that speech of *Lucan* the Poët, concerning the *Arabians* comming into *Thessaly*, in the warre of *Hanniball* and *Pompey*;

*Ignotum vobis Arabes venistis in orbem,
Imbras mirati nemorum non ire sinistras.*

Y^e are come *Arabians* to an vnknowne land.

Wondering the shades nere take the Southward hand.

Which verses are in this sense to be vnderstood; *Poets* are said to looke and turne their faces towards the West, so that the South must of necessity be counted the left side: Now the place whereto the *Arabians* came, being a part of *Thessaly*, where such dwell who only cast their shaddowes one way, to wit, Northward; but *Arabia* their naturall Countrey, being supposed to be included in the *Torrid Zone*, where the shaddowes were said to be cast both wayes, they are said to wonder: The reason why our shaddowes at noone are cast alwayes toward the North, and the others toward the South, is related before, to be because the shaddow doth alwayes occupie or possesse the place opposite to the Sunne, or light body.

12 The *Perisij* are such inhabitants whose shaddowes are mooued round about them in a circular forme.

In some places of the earth the *Noone-shaddowes* take not their beginning from our heads, but of one side, and are extended forward to the plaine of the terrestriall Horizon, and so mooued round about the Opacous body, as about a *Gnomon*: whence they are called *Perisij*; which is as much to say, as men hauing shaddowes mooued round about; such is their habitation which are included in the *Frigid Zone*, circumscribed within the Polar circles, and the Poles: Here the Sunne neuer directly passeth by the crowne of their heads, but at one side: so that they haue the Pole for their verticall point, but

the Equatour, as it were, for their Horizon. These *Periscij* are of two sorts, for some are contained in the *Arcticke* circle, the other in the *Antarcticke*, whereof both are as yet vndiscovered; especially the *Antarcticke*, being farthest off from our climate.

- 1 *The habitation of the Amphiscij comprehends 7. Parallels, of the Heteroscij 41. of the Periscij 6. Moneths.*

Of the nature and accidents of these three sorts of people there needs no more to be spoken, then wee haue deliuered before in this Chapter; Neuerthelesse, for a recapitulation of our former doctrine in this & the precedent Chapter, it will not be amisse to insert this table of Climates, set out by our exactest *Geographers*; wherein is expressed (as it were) to our view the respect and severall accidents, which belong to these severall inhabitants.

- 13 Thus much for the inhabitants absolutely considered: The inhabitants compared one with the other according to their position, are the *Periæci*, *Antæci*, and *Antipodes*.
- 14 The *Periæci* are those inhabitants which dwell in the two opposite points of the *Parallel* circle.
- 15 The *Antæci* are such as dwell vnder the same *Meridian*, but in diuers *Parallels* equally distant from the *Equatour*.
- 16 The *Antipodes* are such as inhabite vnder one *Meridian*, but vnder two *Parallels* equidistant from the *Equatour*; and two opposite points of those *Parallels*.

These

A Table of the Climates belonging to the three
sorts of Inhabitants: Page: 229.

| Inhabitants
belonging to
severall Cli-
mass. | Climes | Parallels | The long-
est summer
day.
Hou. Scr. | Latitude
& elevati-
on of Pole.
Scr. Degr. | The
breadth
of the
Climats.
Degr. Scr | The places by which
the Climates passe. |
|---|--------|-----------|--|---|---|--|
| Amphiscy. | 0 | 0
1 | 12 0
12 15 | 0 0
4 18 | 4 18 | The beginning from
the Aequatour. |
| | 1 | 2
3 | 122 30
1 45 | 8 34
12 43 | 8 25 | Sinus Araticus or
the Red Sea. |
| | 2 | 4
5 | 13 0
13 15 | 16 43
20 33 | 7 50 | Meroe an Island of
Nilus in Egypt. |
| | 3 | 6
7 | 13 40
13 45 | 23 10
27 36 | 7 3 | Siene a City in A-
frica. |
| | 4 | 8
9 | 14 0
14 15 | 30 47
33 45 | 6 9 | Alexandria in E-
gypt. |
| | 5 | 10
11 | 14 30
14 45 | 36 30
39 2 | 5 17 | Rhodes and Baby-
lon. |
| | 6 | 12
13 | 15 0
15 15 | 41 22
43 32 | 4 30 | Rome and Helle-
pont. |
| | 7 | 14
15 | 15 30
15 45 | 45 29
47 20 | 3 48 | Venice and Mil-
laine. |
| | 8 | 16
17 | 16 0
16 15 | 49 21
50 33 | 3 13 | Podalia and Heles-
fer Tartary. |
| | 9 | 18
19 | 16 30
16 45 | 51 58
53 17 | 2 44 | Batavia and Wit-
tenberge. |
| | | 20 | 17 0
17 15 | 54 29
55 24 | 2 17 | Restock. |
| | 11 | 22
23 | 17 30
17 45 | 56 27
57 34 | 2 0 | Ireland and Mos-
covy. |
| Heteroscij. | 12 | 24
25 | 18 0
18 15 | 58 16
59 14 | 1 40 | Bobus a Castle in
Norway. |



Ieteroscij.

| | | | | | |
|----|----------|----------------|----------------|------|--|
| 11 | 22
23 | 17 30
17 45 | 50 27
57 34 | 2 0 | Ireland and Mos-
covy. |
| 12 | 24
25 | 18 0
18 15 | 58 26
59 14 | 1 40 | Bobna a Castle in
Norway. |
| 13 | 26
27 | 18 30
18 45 | 59 59
60 40 | 1 26 | Gothland. |
| 14 | 28
29 | 19 0
19 15 | 61 18
61 53 | 1 13 | Bergis in Norway. |
| 15 | 30
31 | 19 30
19 45 | 62 25
62 54 | 1 0 | VViburge in Fin-
land. |
| 16 | 32
33 | 20 0
20 15 | 63 22
63 46 | 0 52 | Arotia in Sweden. |
| 17 | 34
35 | 20 30
20 45 | 64 6
64 30 | 0 44 | The mouth of Dare-
cally a river of Swede |
| 18 | 36
37 | 21 0
21 15 | 64 49
65 6 | 0 36 | Diverse places of
Norway. |
| 19 | 38
39 | 21 30
21 45 | 65 21
65 35 | 0 29 | Suecia, Alba Rus-
sia. |
| 20 | 40
41 | 22 0
22 15 | 65 47
65 57 | 0 22 | With many Islands |
| 21 | 42
43 | 22 30
22 45 | 66 6
66 14 | 0 17 | Thereunto adioy-
ning, |
| 22 | 44
45 | 23 0
23 15 | 66 20
66 25 | 0 11 | Wanting special
names, |
| 23 | 46
47 | 23 30
23 45 | 66 28
66 0 | 0 5 | And Landmarkes. |
| 24 | 48 | 24 0 | 66 31 | 0 0 | Island under the Ar-
tick circle. |

Here the Cli-
mats are accou-
ted by the moths
from 66 Degr.
31 minut. where
the day is 24
houres unto the
Pole it selfe set
at 90 Degrees
where the artifi-
ciall day is six
Moths.

Menses

| | |
|---|-------|
| 1 | 67 15 |
| 2 | 69 30 |
| 3 | 73 20 |
| 4 | 78 20 |
| 5 | 84 0 |
| 6 | 90 0 |

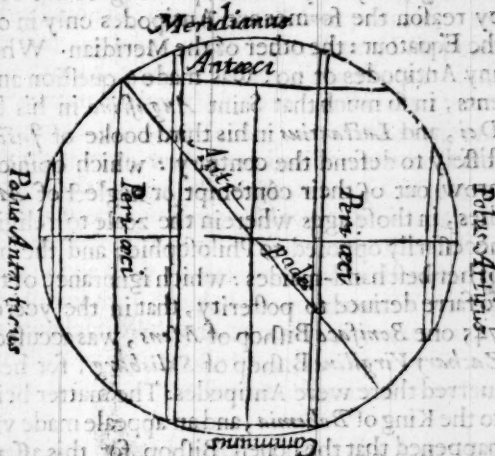
These Climates are supposed
to passe by Diverse Islands
within the Arctick circle, as
Groenland, Island Greenland:
wherein as yet for the narrow-
nesse of these climats comming
neere together, and the uncer-
tainty of observation no speci-
all places have bene assigned
as to the other.

eriscij,

| | | | | | | | |
|----|----|----|----|----|---|----|---|
| 22 | 17 | 30 | 27 | 20 | 0 | 17 | 0 |
|----|----|----|----|----|---|----|---|

These names being originally Greeke are taken from the diuerse manner of dwelling of one nation in respect of another. The *Periæci* are called such as dwell (as it were) about the Hemisphære in the same Parallell in two opposite points: the one in regard of the other being *Easterne*, the other *Westerne*: so that they are supposed to differ the one from the other 180 degrees which is the semicircle:

where we are to note, that these degrees are to be numbered, not in a greater but a lesser Parallell, which is lesse then the Equatour. For they which are vnder the Equatour it selfe in 2 opposite points are to bee ac-



counted rather Antipodes, although (for ought I see) the name might agree. The *Antæci* (as the name imports) are such as dwell one against another, hauing one selfe-same Meridian and equall distance from the Equatour, the one in the Northerne, the other in the Southerne Hemisphære. The *Antipodes* (otherwise called *Antichthones*) may popularly bee described to bee such as dwell feet to feet one against the other: so that a right line being drawne from one side to the other, will passe by the Center of the world: whence they precisely are distant the one from the other 1800 in a greater circle: wherein they are distinguished from the *Periæci*, which are diuided by the degrees of a lesser circle: such compared one to the other are the *Americans* and the *Easterne Indians* about the riuier *Ganges*; the Inhabitants of *Peru* and *Calecute*: those of *Peria* &

Summatra to *England* I finde no other Antipodes but the Sea, or at least some parcell of land in the South continent neere *Psitacorum Regio*; Here is to be noted that the former definition of Antipodes given by the ancients, was only to bee understood of the knowne habitable part of the Earth; because such as dwell directly vnder the *Equatour*, or either of the *Poles*, although they may bee Antipodes agree not to that definition; by reason the former are Antipodes only in opposite points of the *Equatour*: the other of the *Meridian*. Whether there were any Antipodes or no, was made a question amongst the Ancients, in so much that Saint *Augustine* in his booke *de ciuitate Dei*, and *Lactantius* in his third booke of *Institutions*, seemes stiffely to defend the contrary: which opinion is supposed to grow out of their contempt or neglect of *Mathematicall* studies, in those ages wherein the zeale to religion was most vnneccessarily opposed to Philosophie, and the mistresse forsaken of her best hand-maides: which ignorance of the Ancients was so farre deriued to posterity, that in the yeere of our Saviour 745 one *Boniface* Bishop of *Mens*, was accused before the Pope *Zachary Virgilinus* Bishop of *Salisbury*, for heresy, in that hee auerred there were Antipodes: The matter being first preferred to the King of *Bohemia*, and an appeale made vnto the Pope, it happened that the honest Bishop for this assertion, was flatly condemned for hereticall doctrine, and inforced to recant his opinion: yet is it wonderfull how such matters were thus decided: for granting these two easie grounds, First that the earth is *Sphericall*; a proposition proued in their time; 2 That euery place, or at least two opposite places in the Terrestriall Spheare may bee habitable; it must of necessity follow, that such Antipodes must bee granted: which makes me to imagine that Saint *Augustine* absolutely and grossely denied not the *Antipodes*; because in setting downe the premises and grounds, of our opinion, hee seemed to vnderstand them too well to deny a necessary induction, being a man of so great a wit and apprehension: but questionlesse he thought that the *Torrid Zone*, which by most of the Ancients in his time, was reputed vnhabitable and vnpassable, no man had yet set his foot in those remote parts.

parts beyond the line : so that it seemed in him not to arise out of ignorance of the constitution of the earthly Globe : but out of the receaued opinion of the Torrid Zone, and the vast Ocean: the one of which hee held vnhabitable, the other vnpassable: from whence also sprang vp an argument, or rather an idle fancie, that the Antipodes could not be admitted without granting another Sauour, and another kinde of men besides *Adams* posterity : for if this coniecture had not taken place, the Pope (I suppose) would neuer haue proued himselfe so ridiculous a Iudge, as to haue condemned *Virgilius* for heresie. As for *Lactantius* (how-soeuer otherwise a pious eloquent Father) the weakenesse and childishnesse of his arguments, will to any indifferent reader discover his ignorance in the very first rudiments of Cosmographie. Here we may learne how farre religion it selfe is wronged by such who set her opposite to all her seruants. But what-soeuer the Ancients out of their glimring reason haue coniectured, our times haue sufficiently decided this controuersie; wherein such Antipodes are established both by reason and experience: which matter wee shall referue to our second booke; wherein we shall declare how farre, and in what sense the Earth may be tearmed habitable.

- 1 *Those which are to vs Periœci, are the Antœci to our Antipodes: our Antœci the Periœci to our Antipodes: likewise our Periœci are the Antipodes to our Antœci.*

This Proposition as a Corollary may by necessary consequence be deduced out of the precedent definition, and be well expressed out of the constitution of the artificiall Globe, and needs no farther demonstration.

- 2 *The Periœci, Antœci, and Antipodes are diuersly distinguished in respect of the celestially appearances.*

The proprieties of the *Periœci* are chiefly foure. 1 They haue the same eleuation of the Pole, and therefore the same temper

of the yeere, and the same length of dayes and nights. 2 They dwell East and West in regard one of the other. 3 They haue contrary times of dayes and nights: for when the one hath his Noone, the other miroyes his mid-nights: likewise when the Sun with the one riseth, it setteth with the other. 4 They haue the same Zone, Climate, and Parallell; but differ by a semicircle, to wit, 180 degrees. To the *Antarctici* they haue likewise assigned 5 proprieties. viz. 1 They inhabite the like Zones, but in diuerse Hemispheres. 2 They haue the same elcuation of the pole, but not of the same pole: because the one sees the pole *Arcticke*, the other the pole *Antarcticke*, equally raised aboue his *Horizon*. 3 They haue Noone and Mid-night iust at the same times. 4 They miroy the same temper of the Heauens. 5 They haue the seasons of the yeere contrary. For when the Southerne *Antarctici* haue their Summer, the Northerne haue their Winter; and contrariwise: when the Northerne haue their spring, these haue their Autumne. To the *Antipodes* they haue allotted 3 Proprieties. 1 That they haue the same elcuation of the pole, though not of the same pole. 2 They haue the same temper of the yeere, and the same quantity of dayes and nights. 3 They haue all the other accidents contrary: For when the one hath Night the other hath Day, when one Winter, the other Summer; when the one the Spring, the other Autumne; and contrariwise. These accidents and proprieties here mentioned, must be vnderstood in respect of the Heauens only. The qualities arising from diuerse other Accidentall and particular causes in diuerse places of the Earth, we shall differre vnto our second part.

CHAP.

C H A P. XI.

Of the Longitudes and Latitudes.

THe distinction of the Terrestriall Globe according to certaine *Spaces*, being formerly explained, we are now to treat of the Distinction of the said Spheare according to certaine *Distances*.

2 A Distance here we vnderstand to be a direct line drawne betwixt two points in the Earth: such a Distance is twofold, either *Simple* or *Comparatiue*.

3 The Simple Distance is taken from the two great circles, to wit the *Meridian*, or the *Equatour*: which is either the *Longitude* or *Latitude*.

The diuision of *Distances* into the *Simple* or *Comparatiue*, is most necessary: for it is one thing for a place absolutely taken in it selfe, to be distant from some fixt point or other in the Globe: Another for two places to be compared betwixt themselues in regard of such a fixt point: for as much as the former implies only the distance betwixt two points, the other the distance of two such points or places in respect of the third. These points, from which such points are said to be distant, are either found in the Meridian Circle, from which the Distance is called *Longitude*; or else in the Equatour, whence we call it *Latitude*.

4 The

4 The Longitude is the distance of any place Eastward from the first Meridian.

To vnderstand the better the Longitude, we must consider that it may be taken two wayes: either *Generally*, or *Specially*: In the former sense it is taken for the Distance of the whole Earth, stretched from the West vnto the East, and contrariwise from East to West. The bounds or limits of this Longitude were by *Ptolomie* and the ancient Cosmographers set no farther distant then the halfe circle, containing 180 degrees; because the rest of the Earth lay at that time vndiscovered. The end of this space towards the East, was the Kingdome of *China*, at the farthest part of all *India*, distant, as wee said, from the *Fortunate* Islands where *Ptolomie* placed the first Meridian, 180 degrees: which being taken in the Meridian, and resolved into Miles, according to our former rules, will giue 10800 *Italian* miles: but this space delineated out by the Ancients, was very scant and narrow in respect of the other parts since found out, being added to the former. For beyond the bound set by *Ptolomie* in the East, it is manifest that 60 degrees are found out and made knowne. An example whereof wee haue in *Scythia* without the mountaine *Emans*, which is knowne to extend it selfe 60 degrees Eastward towards the Kingdome of *Cathay*, discovered by the *Portugals*: so that the breadth of the Earth Eastward is fully knowne so farre as 240 degrees, which being measured in the Equatour will amount vnto 14000 miles. Moreouer towards the West, beyond the *Fortunate* Islands, it is knowne to stretch to the farthest border of *America*; so that 340 degrees of the earth is fully detected, if not all the rest being only 20 degrees, which are only deficient to make vp the whole circle. Which wee may the sooner credit; because our times haue brought forth (for ought any Authors haue related) the most excellent Nauigators of all ages, which haue sayled the vast Globe of the Earth round about, and left behinde them a foundation whereon others might easily build. But to let passe the Generall Longitude of the Earth betwixt the East and the West; Wee must vnderstand that the Longitude here
 mentionde

mentioned is to bee taken in a more speciall sense, for the Distance of any place from the first Meridian, being placed either in the *Canaries*, as the Ancients would haue it, or in one of the *Azores* according to the latter Geographers. This then must be the bound from whence wee must beginne our account; The subiect wherein the number of degrees may bee taken, may bee the Equatour or Parallell. Whence by some the Longitude of a place is defined to bee an Arch of the Equatour or Parallell intercepted betwixt the first Meridian and the verticall point of the place proposed: so that by necessary consequence, such places as are subiect to the same Meridian, in the same Hemisphære, Easterne or Westerne, haue the same Longitude, which is the distance from the point of the West: but places declining more towards the East haue the greater Longitude; but neerer to the West, lesse.

- 1 *Places inioying the same Longitude are not alwayes equally distant from the first Meridian, and contrarywise places equidistant from the first Meridian haue not alwayes the same Longitude.*

The reason is euident out of that which hath beene often spoken before: because the degrees of a greater circle are greater, of a lesser lesse, according to the greatnesse of the circle. Now the Longitude of a place measured in the Equatour, will answer to 60 *Italian miles*: but in other Parallels lesse.

- 2 *The difference of Longitudes begets the difference of Times: Those therefore which exactly are subiect to the same Longitude, haue their Noone at the same moment: but where the Longitudes are different, the Noonetides are also different.*

That the difference of time is varied according to the difference of Longitude in diuerse parts of the Earth, is a matter obuius to euery mans vnderstanding, out of two premised grounds. 1 That the Earth is Spharicall. 2 That the Sunne in his Diurnall course once in 24 houres compasseth it round: whence it comes to passe that places situate *Eastward*, see the Sunnes sooner then those which are placed in the West, and that with a proportionall difference of time, that to euery houre in the Sunne motion is assigned a certaine number of correspondent miles: which is in some sort expressed in a Geographycall Globe or Map, wherein we shall finde described 12 Meridians, which diuide the whole compasse of the earthly Spheare into 24 equal parts: in such sort that betwixt each of the two neereft Meridians, are reckoned 15 degrees, which make one houre: by which wee may more easily vnderstand how soone the Noone-time happens in one Citty before another: for if one Citty stands Eastward from another the space of three of those foresaid Meridians, it is euident that it will inioy noone three houres before the other. The reason of this difference of times, is the difference of Longitudes, wherein to euery houre the Cosmographers haue allotted 15 degrees in the Sunnes Diurnall motion: so that 15 degrees multiplied by 24 houres, which is the whole naturall day, there will bee produced 360 which is the number of degrees in the whole circle,

- 3 If two men from the same place trauell, the one Eastward, the other Westward round about the Earth, and meet in the same place againe: they shall finde that he which hath gone Eastward hath gotten, and the other going Westward hath lost a day in their account.

This is without difficulty to be vnderstood, out of the change of Longitudes, seconded by their trauell, varying perpetually the quantity of the day: for it is manifest, that hee who from any place assigned sailleth Eastward mouing continually against the

the motion of the Sunne, will shorten somewhat of his day; taking away so much from it, as his iourney in proportion of distance, hath opposed and anticipated in the time the Diurnall course of the Sunne: so that daily gaining something from the length of the day, which must bee elsewhere recompenced. It must needs be, that in the whole circuite of the earth, it will amount to 24. houres, correspondent to the whole circuite of the Sunne, and the compasse of the earth, which will make another day: Likewise, if we suppose another in compassing about the earth, to goe Westward; it cannot bee otherwise imagined, but that seconding the course of the Sunne, by his owne iourney; hee will daily adde somewhat to the length of his day, answerable to his distance, from the place wherein hee began to follow the Sunne in his course from East to West. The daily addition to the length of the day, proportionall to the longitudes which he changeth, (the Sunne running a like course) must daily diminish somewhat of the Diurnall course of the Sunne, and so at his iourneyes end, which was supposed to be the whole circuite of the earth, answerable to 24. houres in the Sunnes course, it will loose a whole day. To demonstrate both these cases, wee will imagine in supposition, that of these two traauillers going the one Eastward, the other Westward, the former should take away from the length of the day, or the latter adde to it for euery 15. miles one minute. Then by the golden Rule, if 15. miles either subtract or adde one minute in the length of the day, must 21600. miles, which is the whole compasse of the earth, according to the same proportion, either subtract or adde 1440 minutes, which make 24. houres, the length of the naturall day. To confirme the demonstration by popular experience, I remember I haue read in the *Hollanders* discouery of *Fretum de Mayre*, that comming home into their owne Countrey, they found by comparing their accounts with their countrymens at home, they had lost one day, hauing gone Westward, and so compassed the earth round. Hence will arise diuers conjectures not vnpleasing to be scann'd. One I will touch not much dissonant from our purpose; *That three men residing*

in the same place at one time, shall notwithstanding all vary one from the other in the dayes of the weeke, keeping yet an exact account: which to explaine the better, wee will suppose a *Jew*, a *Sarazen*, and a *Christian*, residing in the same towne together: It may so happen according to our former grounds, that the *Sarazen* according to the Law of *Mahomet*, shall obserue his Friday, the *Jew* his Saturday, being his Sabbath: and the *Christian* the Lords day, being the Sunday; yet so, as all shall happen on the same day: all of them excluding any error in their calculation. For supposition sake, wee will place them all at one time all together in *Palestine* on a Saturday; at which time, let vs imagine the *Sarazen* to take his iourney Westward, the *Christian* Eastward, so as both of them in their coasts compass the world, to meet againe in the same place: The *Jew* all the while we suppose resident in the same place: it will follow by necessary consequence, that the *Sarazen* going about the earth Eastward, will loose one day; the *Christian* iourneying Westward, will gaine one day: the *Jew* remaining in the same place, will neither gaine nor loose. These three men then, meeting together againe after a yeere, two, or three, at the same place, must needs make diuers account; for one and the selfe-same day, will bee to the *Sarazen* Friday, to the *Jew* Saturday, and to the *Christian* Sunday, if they exactly calculate the time from their first meeting, to their returne vnto the same place. Mee thinkes this, if there wanted other Arguments, were a reason sufficient to conuince some strait-laced men, who rigidly contend our Lords day (which they erroneously tearme the Sabbath) to bee meerely morall, as grounded on the Law of nature. If it were so, according to our premises before demonstrated, this absurditie would ensue necessarily: That the Morall Law, which they call also in a sort the Law of nature, is subiect to manifold mutation, which by our best Diuines is vtterly denied. The consequence will easily follow, because it cannot be denied by any Christian, but that all nations of the world issued from *Noahs* Arke, the Seminary of mankind, and spread themselves from thence ouer the face of the whole earth, some farther, some at a shorter

ter distance : whereby changing the longitude with their habitation, they must of necessity alter the differences of times, when on they seeke to ground their Sabbath. Neither at this day can any man exactly and precisely obserue any one day, either as it was first appointed by *Moses* in the *Leuiticall* Law, as it was instituted by Christs Apostles afterwards ; by reason of the manifold transportation of colonies, and transmigration of Nations from one Region into another, whereby the times must necessarily bee supposed to vary. And if any more moderate should vrge, that not the exact seuenth day from the first institution, bound vs to obseruation ; so one day in seuen bee obserued : it can hardly passe without exception, for as much as if any man, as *Magellane*, *Drake*, or *Candish*, should trauaile the world about, a day must needs be varied, as we haue shewed. Here I would willingly demand, whether such traailers returning home into their owne countreyes, should celebrate the same Lords day according to the institution of their owne Church ; or else as they finde according to their owne account : If they obserue the latter, they must ichismatically diuide themselves from the Church, and keepe a Sabbath of their owne, which in euery mans iudgement would be thought absurd, as the mother of many inconueniences : If the former take place, then must the day be changeable in his nature, and so one day of seuen of them should not be obserued. I speake not this to cherish any neglect of the duty we owe that day, but rather to proue it not meere to be grounded on the Law of Nature, as some would perswade ; but rather an *Ecclesiasticall* constitution, derined (as it seemes most probable) from the Apostles, though not in practice in Christs time, wherein the *Jewish* Sabbath was not yet abolished : But I haue dwelt too long on this, & may perhaps incurre sharpe censure, for wading too farre into the depth of Diuinity : But my Apology shall be this, that albeit I haue gone beyond my present subiect, I haue not yet transcended the limits of my profession : I serue no faction, and therefore dare aduenture my language as free as my opinion.

- 5 Concerning the longitude, two things are to be knowne, 1. The Inuention. 2. The Expression. The Inuention proposeth vs the way and manner of the first finding out of the longitude of places.

There are few things in nature which haue more perplexed the wits of ingenious *Mathematicians*, then the exactest way of finding out the longitude of places: Not that the matter was ouer difficult in it selfe; but that they sought out a way to performe this conclusion, not depending from the obseruation of the celestiall bodies and motions; a matter as yet neuer found out, and I feare mee vnpossible: Because they proposed to themselues one of these two wayes to finde it out; either by some magneticall instrument, or else by industry of nauigation: neither of which can much profit. Not the former, because there haue neuer beene any fixed points found in the *Equator*, betwixt East and West, as betwixt North and South haue beene obserued: so that nothing can proceed out of the meere nature of the earthly Globe, whereon wee may ground any difference of longitude: Neither is the second very beneficiall, for that all voyages both by Sea and land, are very irregular and vncertaine, either by reason of sundry impediments, as rockes, mountaines; woods, contrary winds, and other dangers turning aside the direct course of passengers from any direct way, or obseruation; or else by the Ignorance of Mariners, which seldome passe so farre on discouery: and if they doe, know not perfectly to delineate out their journey, as a *Cosmographer* would expect, to any tolerable satisfaction. Neuerthelesse, by Astronomicall obseruation, wee haue many wayes left vs for the performance of this conclusion, as shall bee taught in these following propositions.

- 1 *By an Eclipse of the Moone, the longitude may be found.*

This

This conclusion is in this sort to bee performed: First, it behooueth you to know, as you may by an *Ephemerides*, at what houre an Eclipse shall happen at some knowne place, whereof you are well informed of the longitude: Then must bee obserued by an Astrolable, or other Astronomicall instrument, at what houre this Eclipse begins at that place, whereof you would willingly know the longitude: If the Eclipse doe beginne in both places the selfe-same time, you may assure your selfe that these two places differ not in longitude. But if there be a difference in the time, then must there be a difference in the longitude, which to finde out, you may in this sort proceed: Take the lesser summe of houres out of the greater, and there will be remaining, either houres or minutes, or both: If there remaine houres, then multiply the same by 15; if minutes, diuide the same by 4; (for in this account as wee haue taught, 15. Degrees make an houre) and adde the difference so found vnto the longitude, if the Eclipse appeare there sooner: but if later, subtract it from the longitude formerly knowne. If there remaine any minutes after the diuision, you must multiply those minutes by 15; and so shall yee haue the Minutes of Degrees. To explaine this the better, wee will take this familiar example from some of our later writers. The longitude of *Paris* was set downe by *Ptolomy*, to be 23 degrees; now we may be informed by an *Ephemerides*, that a certaine Eclipse of the Moone beginnes there 3 houres after midnight; out of this I would willingly learne the longitude of *Tubing* a towne in *Suenia*: In this towne I obserue by some Astronomicall instrument, at what houre the Eclipse there beginnes, which I finde to bee at three of the clocke and 24 minutes after midnight. Then by the subtraction of the lesser number of time out of the greater, I finde the remainder to be 24 minutes, which diuided by 4. which makes one degree, the quotient will bee 6. degrees: and that is the difference, which if you adde to the knowne longitude of *Paris* (because the Eclipse begins there sooner then at *Paris*) it will amount to 29 degrees; whereby we may collect that the Longitude of *Tubing* is 9. degrees. To this rule for the most part are squared all *Cosmographicall*

Tables of longitude, but yet in this happen diuers errors: 1. Because oftentimes in the Artificer there wants diligence in observing the right houre & moment of the Eclipse. 2. The diuers Equacts & latitudes of the Moone are commonly neglected; wherefore some haue thought it the best way (if it were to be hoped) that diuers exact Astronomers should at diuers places obserue the same Eclipse, and so by conferring together according to the former Rule, finde out the longitudes of those places. But exact Astronomers cannot be so easily found in euery citie, whereof we desire to know the longitudes; or if there were such, they keepe not alwaies such correspondency in friendship; neither is an Eclipse of the Moone alwayes at command. Neuerthelesse, this way is not to bee despised, because where better wayes are wanting, wee must content our selues with what we finde.

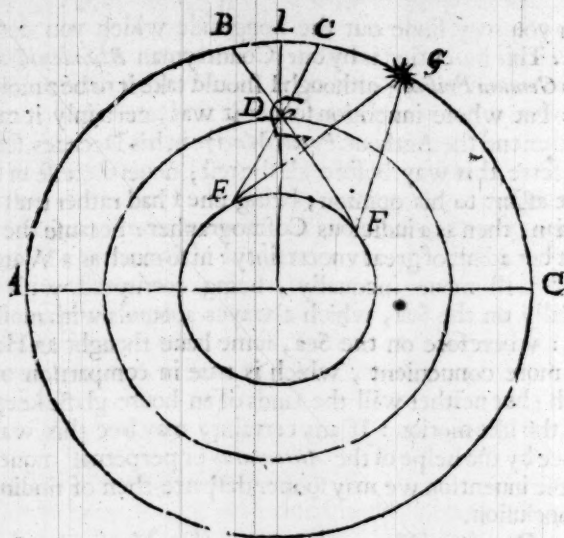
2. *By a Clocke, Watch, or Houre-glasse, to finde out the longitude of a place.*

This conclusion is to be performed in this manner; You must get you a watch or clocke, apt to runne (if you can) 24 houres; this watch must you, by the helpe of an *Astrolabe*, rectifie and set iust at such time as you depart from the place where you are, as bound to any other place, whereof you desire to inquire the longitude: during which time, your diligent care must be to preserve your watch in motion without intermission: being at last arrived at the place whereof you inquire the longitude, you were best to stay till such time as the Index shall precisely point out some perfect houre: At the same instant it must be knowne by an *Astrolabe*, what houre it is at the place where you are arrived; for if your *Astrolabe* and *Watch* should both agree in one, you might assure your selfe that there is no difference of longitude betwixt the place whence you came, and the place whereto you are arrived: For it is euident that in this sort your journey hath beene either directly North or directly South vnder the same Meridian. But if this differ either in houres or minutes, they must be reduced vnto degrees in such sort as we haue shewed in the former way. Through which

which you may finde out the Longitude which you desire to know: This inuention is by our Countryman *Blundenill* ascribed to *Gemma Frisius*; although I should take it to bee more ancient: but whose inuention soeuer it was, certainly it cannot but commend the Authour. *Peter Martyr* in his Decades, seemes to preferre this way before all the rest; neuertheless in this I cannot assent to his opinion, being one I had rather trust as an Historian, then as a iudicious Cosmographer: because the way cannot but admit of great vncertainty: in so much as a Watch or Clocke will moue inequally, being corrupted with rust, especially on the Sea, which alwayes abounds with moist vapours: wherefore on the Sea; some haue thought an Houre-glasse more conuenient, which is true in comparison of the Watch; but neither will the sands of an houre-glasse keepe alwayes the like motion: If any certainty may bee this way, it must bee by the helpe of the *Automaton* or perpetuall moueable, of whose inuention we may sooner despaire then of finding out this conclusion.

3 By the distance betwixt the Moone and some knowne Starre, which is situate neere the Eclipticke, the Longitude may be found out.

This way was taught by *Appian*, illustrated by *Gemma Frisius* and *Blundenill*, to whose manner of explication, wee haue for farther illustration added a figure of the *Parallax* whereon this inuention is grounded. First then to shew this conclusion, wee must first lay this ground: that the Distances betwixt the Moone and other starres in the firmament are varied according to the difference of places: In so much as two men liuing farre distant in diuers places of the earth, beholding at one time the Moone and some other knowne fixt starre, will not finde the like distance betwixt them: whereof if any man doubt, he may be informed by this figure. Wee will imagine O to be the place of the Moone, as seated in the lower Orbe; G to bee the place of the fixt starre, whose distance from the Moone is inquired: E and F two stations and habitations of men dwelling on the earth, whereof wee may imagine the one to bee in *Europe*, the



other in *America*: It will be manifest that the inhabitant situate in *F* will behold the Moone in the point *B*; and the said fixt starre in *G*: (because as the *Optickes* teach vs, all things are seene in the places opposite to the eye) so that the distance betwixt the Moone and the said starre, will bee the Arch of the greatest Circle *B G* of the other side: the inhabitants situate in *E*, will behold the Moone by the ray *E C* in *C*, as likewise the said fixt starre *G* in the point *G*, by the ray *E G*: so that the distance betwixt the Moone and the fixt starre, will bee in that station the Arch of the circle *C G*. Now by the first common *Axiome* of *Euclide*, every man must grant that the Arch of *B G* is greater then *C G*, the former being the whole, and this the part. Secondly, out of the same ground, wee may as easily collect that this distance betwixt the Moone and some other knowne fixt starre is varied proportionally, according to the distances of the places on the earth, because so many places as there are, so many diversity.

uerſity of aſpects will ariſe, being increaſed or diminifhed, according to the diſtances of places on the Terreſtriall Globe: This concluſion thus demonſtrated, wee muſt proceed to practice in this manner, as is taught by *Gemma Friſius*: Firſt, it behooueth you to ſearch out by the helpe of *Aſtronomical Tables*, the true motion of the Moone, according to the Longitude, at that time of your obſeruatiſon at ſome certaine place, for whoſe *Meridian* the rootes of thoſe Tables are calculated. 2. You muſt know the Degree of Longitude of ſome fixed ſtarre, nigh vnto the Eclipticke, either preceding or following the moouing of the Moone. 3. You muſt ſeek out the Diſtance of moouing of the Moone, and the ſaid ſtarre. 4. The diſtance once had, apply the croſſe-ſtaffe to your ſight, and ſo mooue the Croſſe to and fro, till you may behold the Center of the Moone, at the one ende, and the fixed ſtarre with the other. So ſhall you ſee expreſſed by the Degrees and Minutes marked on the ſtaffe the diſtance of the Moone and the ſaid ſtarre correſpondent to the place of your obſeruatiſon: which being noted, ſet downe alſo the diſtance betwixt the Moone and the foreſaid Starre which was firſt calculated. Then ſubſtract the leſſer from the greater, the reſidue will ſhew the leaſt difference: which being diuided by the moouing which the Moone maketh in one houre, you ſhall know the time in which the Moone is or was ioyned with the firſt diſtance of the foreſaid ſtarre. Then hauing conuerted that time into degrees and minutes, the reſt will be performed either by addition or ſubſtraction of the Product thereof to or from that Meridian: for which the Tables where by you firſt calculated the motion of the Moone, were appointed and verified. If the diſtance betwixt the Moone and the fixt Starre of your obſeruatiſon bee leſſer, then muſt you adde the degrees and minutes to the knowne Latitude, ſo ſhall you finde the place of your obſeruatiſon to bee more Eaſtward. If it bee greater, then ſubſtract the degrees and minutes from the knowne Longitude, and the place of your obſeruatiſon in this regard will bee more Weſtward. Theſe rules are ſo farre true that the Moone bee ſuppoſed to bee more Weſtward then the

fixed Starre: for if otherwise, your working must be cleane contrary: to wit, if the distance betwixt the Moone and the fixed Starre bee lesser, you must subtract the degrees and minutes from the knowne Longitude: so shall the place of your observation bee more Westward: but if it bee greater, then must you adde the degrees and minutes vnto the knowne Longitude, and the place of your observation shall bee found Eastward. This way, though more difficult, may seeme better then all the rest: for as much as an Eclipse of the Moone seldome happens, and a watch, clocke, or houreglasse cannot so well bee preserved, or at least so well obserued in so long a voyage: wherea euery night may seeme to giue occasion to this experiment: if so bee the ayre bee freed from clouds, and the Moone shew her face about the Horizon.

4 *By the obseruation of the difference in the Sunnes and Moones motion, the Longitude of places may be found out.*

To explaine this proposition, wee will set downe three things.
 1. Certaine *Postulata*, or granted Axioms. 2. The example.
 3. The manner and practise: The grounds or propositions which wee take as granted of all Mathematicians are these. 1. That the motion of the Moone is 48 minutes of an houre slower in 24 houres, or 360. degrees, then that of the Sunne. 2. That by obseruation of the heauens, and other Mathematicall helpes, an Artificer may know in any place first the Meridian: Secondly the houre of the day: Thirdly the time of the Moones coming to the Meridian. 3. The time of the Moones coming to the Meridian may bee knowne by an *Ephemerides*: These things granted, wee will suppose for example, that in *London* the Moone on some set day comes to the Meridian at foure of the Clocke after Noone: 2. That in some part of the *West-Indies*, the Moone bee obserued to come to the Meridian the same day at 10 minutes after foure. These grounds thus set downe, the distance of Longitude of that place Westward from *London* may bee found out. The manner of practise is thus to bee wrought.

wrought by the golden Rule. If the difference of the Sunnes and Moones motion bee 48 minutes of an houre in 360 degrees; what will it be in 10 minutes? The fourth proportionall number will bee 75 degrees; the distance of Longitude of the place assigned from *London*, in West Longitude; from which number the Longitude from *London* being subtracted, and the remainder from 360, the residue will shew the Longitude. If the Moone in the place assigned come former to the Meridian; wee must count so much in East Latitude. This way I first found in Mr *Purchas* his relation of *Halls* discovery of *Greenland*, written by *William Bassin* since this Chapter came vnder the Presse: the expression of which, being as I suppose shorter and easier then in the Author, I doe owe for the most part to my worthy Chamber-fellow, Mr *Nathanael Norrington*, to whose learned conference, I confesse my selfe to owe some fruits of my labours in this kinde; and all the offices of friendship. This manner of inuention, for mine owne part, I preferre before all the rest, both for certainty and facility; and (as it should seeme by *Bassins* practise) it is more in vse amongst Mariners then the former, howeouer lesse mentioned amongst writers.

14 Thus much for the *Inuention* of the Longitude: the *Expression* is the imitation of the Longitude on the face of an Artificiall Globe or Mappe; which is directed by these Rules.

1 The place whereof wee desire to know the Longitude being brought to the *Brassen Meridian*, the degrees of the *Equatour* will shew the Longitude.

This Rule may easily be explained by these three precepts. First that you must turne round the Globe on his Axell-tree, till you bring the place whereof seek the Longitude vnder the *brasse Meridian*. 2 You must diligently and exactly marke what

degree the Meridian cuts in the Equatour. 3. You must number how many degrees that point is distant from the first Meridian, and the number will giue you the true Longitude sought after. This also may be performed without turning of the Globe, if so be any other Meridian in the globe signed out shall passe by the said place. For this Meridian will cut the Equatour in some degree or other, which being numbred, as before from the first Meridian, will shew the direct Longitude: the like of which we haue in the second case.

2. *The Meridian running through any place of the Geographickall Table, will point and designe out in the Equatour the degrees of Longitude.*

This may easily bee taught by the former way performed on the Globe: as for example, if I should inquire the Longitude of *Paris* the *Metropolis* of *France*, in a Geographickall Map, I finde a Meridian markt out which runs, if not directly through yet very neere the said City. This Meridian I trace along to the Southerne part, till I finde it to meet and cut the Equatour. Then obserue I in what degree of the Equatour it makes his intersection, and I finde it to bee 23 degrees 20 minutes, which is the Longitude of the place.

15. *Hauiug spoken of the Longitude, the Latitude comes in the next place to bee handled: the Latitude is the Distance of any place from the Equatour, either North or South.*

What we haue spoken of the Longitude must also agree to the Latitude, that it is taken sometimes absolutely and generally, sometimes specially: in the former sense it signifies any distance or space betweene North and South, or contrariwise from South to North. Amongst the Ancients was the breadth or Latitude held to bee about 80 degrees, so that the utmost bound

bound or limit to it Northward was called *Thule*, which commonly is supposed to bee *Island*. But the latter Nauigatours through their diligence haue detected so much land that it is found to stretch beyond 81 degrees toward the North, and 45 toward the South, and much farther if we will beleeeue the relation of *Ferdinand de Quir*, a Spaniard, who boasts a more ample discovery of the *South Indies*, then euer before hath beene knowne. But howsoeuer, the Latitude here define is taken in a more speciall and stricter sense for the distance of any place from the equinoctiall line, bee it either toward the North or the South. The bound therefore from which we begin our account of Latitude is the Equatour: but the subiect wherein it is measured is the Meridian: so that it is cleane opposite to the Longitude, for that was limited by the Meridian, and measured in the Equatour. The Latitude of a place is alwayes equall to the Elevation of the Pole, as wee shall shew hereafter, and is diuided into the Northerne and the Southerne Latitude, whereof the one is from the Equatour Northward, the other Southward.

16 Concerning the Latitude are to bee considered the *Inuention*, and the *Expression*: the Inuention is againe twofold, *Astronomicall*. or *Magneticall*.

17 The *Astronomicall* Inuention of the Latitude is by obseruation of the Starres, which is directed by these Propositions.

1 The Meridian Height of the Sunne at the time of the Equinoctiall subtracted from 90 degrees, will shew the true Latitude of the place.

The height of the Sunne at Noone may be found by the *Astronabe*, *Crosse-staffe*; *Quadrant*, and many other Astronomicall instruments.

instruments, but in taking the Meridian Altitude, it is very fit and requisite that it bee observed diuerse times one after another with some little space betwixt, to trie whether it increaseth or decreaseth; for if it doth increase, then assure your selfe it is not full Noone; if it decrease it is past Noone: hauing thus found out the Meridian Altitude, you must subduct it from 90 degrees, and the residue will bee the true Latitude of the place, if so bee it bee observed at the time of the Equinoctiall, when the Sunne enters the first point of *Aries*, or *Libra*: as for example here at *Oxford* I obserue the Meridian height of the Sunne about the eleuenth of March, and I finde it to bee about 37 degrees, or thereabout, which I subtract out of 90, the whole Quadrant, and the residue will bee 53, which is the Latitude of the place. But if you would know the Latitude at any other day, or time of the yeere, then must you proceed in this manner: hauing taken the height of the Sunne at Noone (as before) you must by the Table of Declination learne the true degree of the Sunnes declination. 2 If such declination bee Northernly, then must you subtract it from the foresaid Altitude or height. But if Southernly, you must adde it to the Altitude: and by such addition and subtraction, shall you haue the height of the equinoctiall aboue the Horizon. 3 This height of the Equinoctiall aboue your Horizon, being as before subtracted from 90, will bee the true Latitude of the place assigned: as for example, the 15 of August I obserue the Declination of the Sunne to bee about 10 Degrees, the Sunne being in 2 Degrees of *Virgo*: I finde the Meridian height of the Sunne to be 48 degrees or thereabouts. Now because the Sunne being in *Virgo*, hath a Northern Declination, I subtract 10, which is the number of the declination, out of 48 the height of the Sunne, and there will remaine 38, which againe taken cut of 90, the residue will be about 52, the common receaued Latitude of the place.

2 *The Meridian height of any Starre, the Declination subtracted, if it bee Northernne, or added*

added if it bee Southerne, being subtracted out of 90, will shew at any time of the yeere the Degrees of Latitude.

The former rule serues onely for the day; because it is performed by the obseruation of the Sunne, but this latter may bee more necessary for Marriners, who now and then are inforced to inquire the Latitude of a place in the night when the Sunne shines not: wherefore they must flie vnto some knowne Starre, by obseruation of which they may easily performe the same; according to the rule: which differes nothing at all from that which wee speake of the Sunne out of the Equinoctiall, and therefore need no other exposition then a bare example: let the first starre you best know, bee *Arcturus*, whose Meridian Altitude you finde by your Mathematicall instrument to bee 59 Degrees, and 30 minutes: then shall you learne by some Table that his Declination Northward is 21 degrees, 30 minutes: now because his declination is Northward, you must subtract it out of his Meridian Altitude, and you shall finde the remainder to bee 52 Degrees, which is the Latitude for the place: as it is commonly taken, although I confesse it might be more exact: being obserued here at *Oxford*, be found rather 51 Degrees and 30 minutes.

18 The Magneticall Inuention is performed by the Magneticall Inclinary Needle.

The ground of this Magneticall inuention is from the proportion betwixt the magneticall inclinatory Needle, and the Latitude of the Earth: for as wee haue proued in the 13 Proposition of the 3 Chapter; the Magneticall inclinatory Needle will at euery point of Latitude conforme it selfe to certaine Angles with the Axell of the Earth proportionally to the Degrees of that Latitude: vpon which grounds Dr *Ridley* hath inuented a curious instrument to finde out the Latitude for any place assigned, and for this vse hath calculated Tables, which wee hope will bee enlarged by our famous Professor Mr *Briggs*: for my part, hauing neuer seene this instrument,

or knowne the vse, I cannot enter on the description of it vntill such time as I shall haue occasion to acquaint my selfe with it.

- 19 The Expression is the imitation of it on the artificiall Spheare: which is againe either *Astronomicall* or *Magneticall*. The former is performed by the ordinary Globe according to this rule.

- 1 *The point of any place or Citty first found in the Globe being brought to the brasen Meridian, will shew in the Degrees of the same Meridian the true Latitude of the same place.*

This may easily be shewed in this manner by an example; If I would willingly finde out the Latitude of *Oxford* in the Globe, I first finde out the place in the Globe, which hauing found, I turne the Globe till I haue brought the place iust vnder the brasen Meridian: then I note what degree it designes, and that shewes mee the true Latitude of the place, which I finde to bee 52, or thereabouts: but if you would finde it in a *Mappe* or *Chart*, in which there is no such brasen Meridian, you must take the Parallell of the place, or at least the next vnto it, pointed in the same *Mappe*: Then note what degree the said Parallell cuts in the first Meridian; for that will shew the true Latitude of it by the right Parallell of the place, if not the next; so that by addition, or subtraction, you may easily guesse at it.

- 20 The *Magneticall* Expression depends from the Application of the *Inclinatory Needle* to the *Terrella*.

The *Magneticall* inclinatory needle is said to conforme it selfe in the same manner to the *Terrella* or *Loadstone*, being artificially thereunto applied, as it doth to the great Globe of the Earth: so that no doubt is, but an imitation of the Latitude
may

**A Table expressing the proportion of the
Magneticall Inclination to the degrees of
Latitude, and Eleuation of the Pole.**

| <i>Elevat.
Poli.</i> | <i>Inclination
to the Hori-
zon. I. II.</i> | <i>Elevat.
Poli.</i> | <i>Inclination
to the Hori-
zon. I. II.</i> | <i>Elevat.
Poli.</i> | <i>Inclination
to the Hori-
zon. O. I. II.</i> |
|--------------------------|---|--------------------------|---|--------------------------|--|
| 1 | 12 11 15 | 31 | 152 26 38 | 61 | 179 28 51 |
| 2 | 14 10 13 | 32 | 153 46 55 | 62 | 180 31 36 |
| 3 | 16 26 55 | 33 | 154 53 51 | 63 | 180 37 54 |
| 4 | 18 31 23 | 34 | 156 3 56 | 64 | 181 10 47 |
| 5 | 110 33 41 | 35 | 157 13 25 | 65 | 181 42 36 |
| 6 | 112 23 50 | 36 | 158 21 19 | 66 | 182 13 23 |
| 7 | 114 37 53 | 37 | 159 27 50 | 67 | 182 43 19 |
| 8 | 116 27 52 | 38 | 160 32 59 | 68 | 183 11 56 |
| 9 | 118 21 50 | 39 | 161 36 46 | 69 | 183 39 45 |
| 10 | 120 13 47 | 40 | 162 39 0 | 70 | 184 6 37 |
| 11 | 122 3 45 | 41 | 163 39 56 | 71 | 184 32 30 |
| 12 | 123 51 46 | 42 | 164 39 29 | 72 | 184 57 24 |
| 13 | 125 37 52 | 43 | 165 37 41 | 73 | 185 21 22 |
| 14 | 127 22 4 | 44 | 166 34 31 | 74 | 185 44 24 |
| 15 | 129 4 23 | 45 | 167 30 0 | 75 | 186 6 31 |
| 16 | 140 44 53 | 46 | 168 24 10 | 76 | 186 27 44 |
| 17 | 132 23 34 | 47 | 169 17 2 | 77 | 186 48 5 |
| 18 | 134 0 27 | 48 | 170 8 38 | 78 | 187 17 36 |
| 19 | 135 35 35 | 49 | 170 58 59 | 79 | 187 26 18 |
| 20 | 137 9 0 | 50 | 171 48 7 | 80 | 187 44 9 |
| 21 | 138 40 42 | 51 | 172 36 0 | 81 | 188 1 10 |
| 22 | 140 10 41 | 52 | 173 22 38 | 82 | 188 17 23 |
| 23 | 141 38 58 | 53 | 174 8 2 | 83 | 188 32 49 |
| 24 | 143 5 37 | 54 | 174 52 11 | 84 | 188 47 29 |
| 25 | 144 30 26 | 55 | 175 35 6 | 85 | 189 1 22 |
| 26 | 145 53 43 | 56 | 176 16 51 | 86 | 189 14 30 |
| 27 | 147 15 25 | 57 | 176 57 28 | 87 | 189 36 54 |
| 28 | 148 35 33 | 58 | 177 36 59 | 88 | 188 38 37 |
| 29 | 149 54 18 | 59 | 178 15 23 | 89 | 189 39 39 |
| 30 | 151 11 9 | 60 | 178 52 41 | 90 | 196 0 0 |

Place this Table after page 252 in the first Booke.

A Table expressing the proportion of the
 Magnetic Inclination to the degree of
 Latitude, and Elevation of the Pole.

| Elevat.
Pole. | Inclination
to the Horiz.
con. I. II. | Elevat.
Pole. | Inclination
to the Horiz.
con. I. II. | Elevat.
Pole. | Inclination
to the Horiz.
con. I. II. | Elevat.
Pole. | Inclination
to the Horiz.
con. I. II. |
|------------------|---|------------------|---|------------------|---|------------------|---|
| 1 | 121 11 141 | 31 | 121 25 132 | 61 | 120 1 28 121 | 91 | 119 11 11 |
| 2 | 121 10 124 | 32 | 121 46 121 | 62 | 120 31 130 | 92 | 119 31 130 |
| 3 | 121 26 122 4 | 33 | 124 123 121 | 63 | 120 1 37 124 | 93 | 119 1 37 124 |
| 4 | 121 31 123 1 | 34 | 126 13 120 1 | 64 | 121 1 10 121 | 94 | 121 1 10 121 |
| 5 | 120 32 124 1 | 35 | 127 12 121 2 | 65 | 121 42 120 | 95 | 121 42 120 |
| 6 | 121 23 120 1 | 36 | 128 21 124 1 | 66 | 122 12 122 | 96 | 122 12 122 |
| 7 | 124 37 121 2 | 37 | 129 27 120 1 | 67 | 122 48 121 | 97 | 122 48 121 |
| 8 | 126 27 121 2 | 38 | 130 34 121 2 | 68 | 123 11 126 | 98 | 123 11 126 |
| 9 | 128 21 120 1 | 39 | 131 36 121 4 | 69 | 123 30 124 | 99 | 123 30 124 |
| 10 | 129 12 124 7 | 40 | 132 33 121 0 | 70 | 124 16 121 | 100 | 124 16 121 |
| 11 | 129 13 124 7 | 41 | 132 32 121 2 | 71 | 124 12 122 | 101 | 124 12 122 |
| 12 | 129 12 124 6 | 42 | 132 30 120 1 | 72 | 124 12 122 | 102 | 124 12 122 |
| 13 | 129 12 124 6 | 43 | 132 27 124 1 | 73 | 124 12 122 | 103 | 124 12 122 |
| 14 | 129 12 124 6 | 44 | 132 24 121 2 | 74 | 124 12 122 | 104 | 124 12 122 |
| 15 | 129 12 124 6 | 45 | 132 20 121 0 | 75 | 124 12 122 | 105 | 124 12 122 |
| 16 | 129 12 124 6 | 46 | 132 14 121 2 | 76 | 124 12 122 | 106 | 124 12 122 |
| 17 | 129 12 124 6 | 47 | 132 17 121 2 | 77 | 124 12 122 | 107 | 124 12 122 |
| 18 | 129 12 124 6 | 48 | 132 18 121 2 | 78 | 124 12 122 | 108 | 124 12 122 |
| 19 | 129 12 124 6 | 49 | 132 18 121 2 | 79 | 124 12 122 | 109 | 124 12 122 |
| 20 | 129 12 124 6 | 50 | 132 18 121 2 | 80 | 124 12 122 | 110 | 124 12 122 |
| 21 | 129 12 124 6 | 51 | 132 18 121 2 | 81 | 124 12 122 | 111 | 124 12 122 |

may bee expresse'd on the little earth, or loadstone : for which vse, diuers curious instruments haue beene deuised by magneti-
call Philosophers, to whom I referre my Readers : because I (as
I said) haue little acquainted my selfe with the vse of such in-
struments.

CHAP. XII.

*Of the distances of places compared one
with another.*

- 1 **O**F the *simple* and *absolute* distinction of
distances, wee haue treated in the
former Chapter : wee must in the last place
handle it *comparatiuely* ; that is to say, one
place compared with another : whereof wee
are to consider the *Inuention* and *Expression*.
- 2 The distance is the measured space betwixt
two places : which is, either *vniforme*, or
various : vniforme is in places different,
either in *Longitude* onely, or in *Latitude*
onely.
- 3 Those places differ in *Longitude* onely, which
are situate vnder the same or like *Parallels*,
but diuers *Meridians* ; or at least vnder op-
posite.

posite points of the same *Meridian*.

Of places differing onely in Longitude, there may bee three cases: For 1. they may be vnder the same Parallell, as the Island of *Sint Thomas*, and *Summatra*, which lie directly vnder the Equatour; or *Noremberg* and *Hamburg*, which hauing very neere the same Latitude, differ in Longitude, and lie in the same Parallell without the Equatour. 2. They may be vnder the like Parallels, that is, in points equidistant from the Equatour. As *Siene* in *Egypt*, vnder the Tropicke of *Cancer*; and *Beach* in the South continent, vnder the Tropicke of *Capricorne*. 3. They may be vnder the same Parallell and Meridian, but in opposite points of the said Parallell: such as are the *Periæci*, spoken of in the 10. Chapter.

- 4 Places differing onely in Longitude, whose distance is here proposed to bee sought out, are seated in the same, or diuers *Hemispheres*.
- 5 In the same *Hemisphære*, when both places haue either Easterne or Western Longitude. This againe may haue two cases; for either the places are vnder the *Equatour*, or without it: in both which, the finding out of the distance shall bee opened in these Rules.
 - 1 If two places vnder the *Equatour* in the same *Hemisphære*, differ in longitude: let the lesser longitude be subtracted from the greater, and the difference conuerted into Miles, and the distance will be knowne.

bles of the miles answerable to the degrees of Latitude.

The former way is performed in this manner: Let the Triangle of two equall sides FBG in the figure before, bee resolved; in which the two equall sides FB, and GB are the complements of equall Latitudes; to wit, AF, and EG. The Angle FBG is the difference of Longitude, which Angle, whether it bee a *Right Angle*, or *Oblique Angle*, will easily bee knowne, if by letting a perpendicular line BI from B to I it be parted into two Triangles FBI and IBG; for because those two Triangles according to the grounds of *Geometry* are equall; the Arch IG in the Triangle IBG being found out, the Arch also IF in the Triangle FBI will also bee knowne: which being thus demonstrated, wee must proceed in this manner, according to the Golden Rule. As the Right angle BIG is to the complement of the Latitude BG, so is IBG the middle difference of Longitude to IG the middle distance: *Pitiscus* in his *Trigonometry* to this addes another manner of demonstration, expresseible by the precedent figure: Let the perpendicular IB be continued vnto K, that BK may make a whole Quadrant. Now will the Triangle IHK haue Right Angles at I and K, at I by supposition, at K by his 57 proposition demonstrated in his first booke: because, *If a greater circle of the Spheare passe by the Poles of a greater circle, it will cut it at right Angles, and contrariwise*: wherefore the sides IH and KH must bee quadrants: because, as hee shewes in his 68 proposition of his first booke; *In a sphericall Triangle having more then one Right Angle, the sides subtending those Right Angles are Quadrants*: Finally, because the Arches GH and EH, are the complements of the Arches IG and KE: by the 9 definition of the first booke, *For as much as of any Arch lesse then a Quadrant, the complement is that which wants to make it up 90 parts*. We may by the helpe of the 57 proportion of his first booke, seeke out the complement of the third side GH; which will be the Arch GI: which will shew vs the problem which wee sought; by reducing

ducing it vnto the Table of signes, and Tangents, exactly se-
 out by our forenamed Author and others. For an example of
 this, wee may take two famous cities of *Germanie*, *Noremberg*
 and *Hamberg*, which without any sensible difference haue the
 same *Latitude*, but differ in *Longitude*: For the *Longitude* of
Noremberg is 31 degrees 45 minutes: of *Hamberg* 32 degrees
 30 minutes: the difference of *Longitude* then is 0 degrees
 45 minutes. These things supposed to be knowne, we will ima-
 gine *Noremberg* to be in F, *Hamberg* in G; and therefore A F,
 or E G will haue 49 degrees 27 minutes: F B or G B will haue
 49 degrees 37 minutes: F B G, or A E will haue 0 degrees 45
 minutes: K E 0 degrees 22 minutes: E H 89 degrees 37 mi-
 nutes: if we worke by the Table of *Signes*, *Tangents*, and *Sec-
 ants*, the knowledge whereof is required to this Probleme.
 But because the former way may seeme difficult to such as are
 not much acquainted with *Trigonometry*, some haue set downe
 an easier way, depending on the vie of a Table, wherein is cal-
 culated the number of miles answering to euery degree of eu-
 ery *Parallell* of the *Sphere*: In which working, we ought to bee
 directed by this Rule: If two places without the *Equator* differ
 in *Longitude* only, subtract the lesser number out of the greater, and
 multiply it by the number of miles answerable to a degree of that
Parallell, and the product will giue the distance. As for example,
 if you would know the distance betwixt *London* and *Antwerpe*,
 which haue in a manner the same *Latitude*, but differ in *Longi-
 tude*: I finde them to differ in *Longitude* by 6 degrees, which
 number being multiplied by 37 miles answerable to 1 degree
 of *Latitude*, there will arise to 247 miles, and 54 seconds of a
 mile.

10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

A Table of Miles answerable to one Degree of every several Latitude.

| 1 | 2 | 3 | 4 | 5 | 6 |
|-----|------|-----|------|------|------|
| D | D | D | D | D | D |
| M | M | M | M | M | M |
| S | S | S | S | S | S |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 16 | 3 | 46 | 61 | 76 |
| 2 | 32 | 6 | 92 | 122 | 152 |
| 3 | 48 | 9 | 138 | 183 | 228 |
| 4 | 64 | 12 | 184 | 245 | 296 |
| 5 | 80 | 15 | 230 | 306 | 357 |
| 6 | 96 | 18 | 276 | 367 | 418 |
| 7 | 112 | 21 | 322 | 428 | 479 |
| 8 | 128 | 24 | 368 | 489 | 540 |
| 9 | 144 | 27 | 414 | 550 | 601 |
| 10 | 160 | 30 | 460 | 611 | 662 |
| 11 | 176 | 33 | 506 | 672 | 723 |
| 12 | 192 | 36 | 552 | 733 | 784 |
| 13 | 208 | 39 | 598 | 794 | 845 |
| 14 | 224 | 42 | 644 | 855 | 906 |
| 15 | 240 | 45 | 690 | 916 | 967 |
| 16 | 256 | 48 | 736 | 977 | 1028 |
| 17 | 272 | 51 | 782 | 1038 | 1089 |
| 18 | 288 | 54 | 828 | 1099 | 1150 |
| 19 | 304 | 57 | 874 | 1160 | 1211 |
| 20 | 320 | 60 | 920 | 1221 | 1272 |
| 21 | 336 | 63 | 966 | 1282 | 1333 |
| 22 | 352 | 66 | 1012 | 1343 | 1394 |
| 23 | 368 | 69 | 1058 | 1404 | 1455 |
| 24 | 384 | 72 | 1104 | 1465 | 1516 |
| 25 | 400 | 75 | 1150 | 1526 | 1577 |
| 26 | 416 | 78 | 1196 | 1587 | 1638 |
| 27 | 432 | 81 | 1242 | 1648 | 1699 |
| 28 | 448 | 84 | 1288 | 1709 | 1760 |
| 29 | 464 | 87 | 1334 | 1770 | 1821 |
| 30 | 480 | 90 | 1380 | 1831 | 1882 |
| 31 | 496 | 93 | 1426 | 1892 | 1943 |
| 32 | 512 | 96 | 1472 | 1953 | 2004 |
| 33 | 528 | 99 | 1518 | 2014 | 2065 |
| 34 | 544 | 102 | 1564 | 2075 | 2126 |
| 35 | 560 | 105 | 1610 | 2136 | 2187 |
| 36 | 576 | 108 | 1656 | 2197 | 2248 |
| 37 | 592 | 111 | 1702 | 2258 | 2309 |
| 38 | 608 | 114 | 1748 | 2319 | 2370 |
| 39 | 624 | 117 | 1794 | 2380 | 2431 |
| 40 | 640 | 120 | 1840 | 2441 | 2492 |
| 41 | 656 | 123 | 1886 | 2502 | 2553 |
| 42 | 672 | 126 | 1932 | 2563 | 2614 |
| 43 | 688 | 129 | 1978 | 2624 | 2675 |
| 44 | 704 | 132 | 2024 | 2685 | 2736 |
| 45 | 720 | 135 | 2070 | 2746 | 2797 |
| 46 | 736 | 138 | 2116 | 2807 | 2858 |
| 47 | 752 | 141 | 2162 | 2868 | 2919 |
| 48 | 768 | 144 | 2208 | 2929 | 2980 |
| 49 | 784 | 147 | 2254 | 2990 | 3041 |
| 50 | 800 | 150 | 2300 | 3051 | 3102 |
| 51 | 816 | 153 | 2346 | 3112 | 3163 |
| 52 | 832 | 156 | 2392 | 3173 | 3224 |
| 53 | 848 | 159 | 2438 | 3234 | 3285 |
| 54 | 864 | 162 | 2484 | 3295 | 3346 |
| 55 | 880 | 165 | 2530 | 3356 | 3407 |
| 56 | 896 | 168 | 2576 | 3417 | 3468 |
| 57 | 912 | 171 | 2622 | 3478 | 3529 |
| 58 | 928 | 174 | 2668 | 3539 | 3590 |
| 59 | 944 | 177 | 2714 | 3600 | 3651 |
| 60 | 960 | 180 | 2760 | 3661 | 3712 |
| 61 | 976 | 183 | 2806 | 3722 | 3773 |
| 62 | 992 | 186 | 2852 | 3783 | 3834 |
| 63 | 1008 | 189 | 2898 | 3844 | 3895 |
| 64 | 1024 | 192 | 2944 | 3905 | 3956 |
| 65 | 1040 | 195 | 2990 | 3966 | 4017 |
| 66 | 1056 | 198 | 3036 | 4027 | 4078 |
| 67 | 1072 | 201 | 3082 | 4088 | 4139 |
| 68 | 1088 | 204 | 3128 | 4149 | 4200 |
| 69 | 1104 | 207 | 3174 | 4210 | 4261 |
| 70 | 1120 | 210 | 3220 | 4271 | 4322 |
| 71 | 1136 | 213 | 3266 | 4332 | 4383 |
| 72 | 1152 | 216 | 3312 | 4393 | 4444 |
| 73 | 1168 | 219 | 3358 | 4454 | 4505 |
| 74 | 1184 | 222 | 3404 | 4515 | 4566 |
| 75 | 1200 | 225 | 3450 | 4576 | 4627 |
| 76 | 1216 | 228 | 3496 | 4637 | 4688 |
| 77 | 1232 | 231 | 3542 | 4698 | 4749 |
| 78 | 1248 | 234 | 3588 | 4759 | 4810 |
| 79 | 1264 | 237 | 3634 | 4820 | 4871 |
| 80 | 1280 | 240 | 3680 | 4881 | 4932 |
| 81 | 1296 | 243 | 3726 | 4942 | 4993 |
| 82 | 1312 | 246 | 3772 | 5003 | 5054 |
| 83 | 1328 | 249 | 3818 | 5064 | 5115 |
| 84 | 1344 | 252 | 3864 | 5125 | 5176 |
| 85 | 1360 | 255 | 3910 | 5186 | 5237 |
| 86 | 1376 | 258 | 3956 | 5247 | 5298 |
| 87 | 1392 | 261 | 4002 | 5308 | 5359 |
| 88 | 1408 | 264 | 4048 | 5369 | 5420 |
| 89 | 1424 | 267 | 4094 | 5430 | 5481 |
| 90 | 1440 | 270 | 4140 | 5491 | 5542 |
| 91 | 1456 | 273 | 4186 | 5552 | 5603 |
| 92 | 1472 | 276 | 4232 | 5613 | 5664 |
| 93 | 1488 | 279 | 4278 | 5674 | 5725 |
| 94 | 1504 | 282 | 4324 | 5735 | 5786 |
| 95 | 1520 | 285 | 4370 | 5796 | 5847 |
| 96 | 1536 | 288 | 4416 | 5857 | 5908 |
| 97 | 1552 | 291 | 4462 | 5918 | 5969 |
| 98 | 1568 | 294 | 4508 | 5979 | 6030 |
| 99 | 1584 | 297 | 4554 | 6040 | 6091 |
| 100 | 1600 | 300 | 4600 | 6101 | 6152 |

6 The distance of places differing only in Longitude in diuerse Hemispheres is found out by this rule.

1 Let the greater longitude be subtracted from the whole circle, and vnto the residue added the lesser longitude, there will arise the distance betwixt those places.

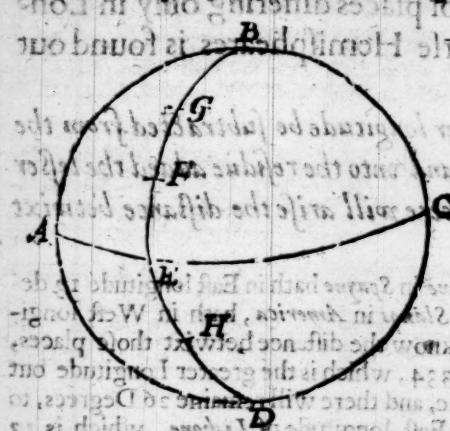
As for example, *Lisbone* in *Spain* hath in East longitude 13 degrees: and *Cap de Los Santos* in *America*, hath in West longitude 334 degrees: to know the distance betwixt those places, you must first subduct 334, which is the greater Longitude out of 360 the whole circle, and there will remaine 26 Degrees, to which if wee adde the East longitude of *Lisbone*, which is 13 degrees, it will make 39 degrees, which is the true difference of those longitudes: which being multiplied by the Number of miles in the Table going before, answerable to the latitude of the said places (if they differ only in longitude) there will arise the number of miles contained in the Distance.

7 Distant places which differ onely in latitude, are such as lye vnder the same Meridian, but diuerse Parallels: These are supposed to be either in One, or in Diuerse latitudes or Hemispheres.

8 In One, when both the places haue either North latitude, or both South Latitude: The finding out of which distances depends on these Propositions.

1 If the latitude of each place be towards the same Pole, subtract the lesser from the greater latitude, and the residue conuers into miles.

The reason may bee explained in this Figure: wee will imagine



E F to bee the lesser, E G the greater latitude. There will remaine an Arch of the Meridian F G: which being multiplied by 60 (being part of a great circle, will make the nūber of miles answerable, to that distance. For an example we will take two Cities of England, Oxford and Torke. The latitude

Oxford, we take to be 51 degrees 30 minutes: of Torke 54 degrees 30 minutes. The lesser latitude subtracted from the greater, there will remaine three degrees, which being multiplied by 60, will render 180 Italian-miles, the Distance of these two places.

If two places in latitude only distant, be situate in diuerse kindes of latitude, adde the latitude of the one to the other, and the whole summe shall be the distance.

As for example, in the former Diagram, imagining as in the former case B D to be the Meridian of those distant places, and A C the Equatour, we will suppose the one place to bee situate towards the North Pole, as G, the other towards the South, as in H: then as appeares by sense, will the distance bee the Arch of the Meridian G H, whereof G E, and E H, are parts, whereof it is compounded: wherefore it must needs follow that those parts added together make the whole distance: for example we will take *Bellograde* in Europe, and the *Cape of good hope* in Africa, which haue nere the same longitude, to wit, 48 degrees 30 minutes:

minutes: but they differ in latitude in such sort, as the former hath of the Northerne latitude 44 degrees 30 Minutes; the other of Southerne latitude about 35 degrees 30 minutes. These two numbers added together, will make 80 degrees, which being multiplied by 60 will produce 4800 miles the distance of those places.

9 Hitherto of the distances of places which are *Vniforme*, that is to say, of such as differ either only in *longitude*, or onely in *latitude*: wee are next to consider of such distances as are *various*, wherein the places differ both in *longitude* and *latitude*.

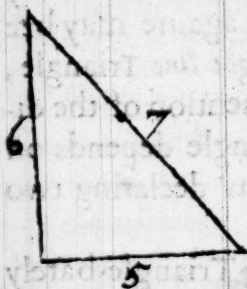
10 The Inuention of such a distance, may be performed two wayes, either *Abstractiuely* by the resolution of *Triangles*, or else *Mechanically* by instruments. The former againe may be two wayes, either by the *Right-line* Triangle, or by the *Sphericall*: The inuention of the distance by the *Right-line* Triangle depends on these following Propositions declaring two wayes of inuention.

11 The first is by a Rectangle Triangle barely considered by it selfe, according to this Theoreme.

i The square Root of the number made of the differences of *longitude* and *latitude* of two places distant, will shew the distance of those places.

The ground of this Proposition is taken from the 27 Proposition

of the first booke of *Euclid*: where it is demonstrated that the square of the Hypotenuse, or greatest side of a Rectangle Triangle is equall to the two squares made of the two other sides: which being well vnderstood, will lend an easie light to this proposition. To performe which we must first take the difference of longitude, which is imagined to make one side of this Triangle. Then we must obserue also the difference of latitude, which is supposed to make another side. Then are we sure by the former Proposition of *Euclid* that the squares of these two sides, are equall to the square of the Hypotenuse, or third side, which is to be sought out, and expresse the distance betwixt those places: wherefore we must first multiply these two sides in themselves, whence they will become squares. 2. We must adde them together. 3 We must out of the totall extract the quadrat root, which will shew the distance: as suppose according to this Figure, two Cities distant and differing both in longitude and latitude: whereof the one shall haue in longitude 21 degrees, in latitude 58: the other is supposed to haue in longitude 26 degrees, in latitude



52. Here first I subtract the lesse longitude out of the greater, to wit, 21 out of 26, and the residue will bee 5, which I suppose to be one side of the Rectangle Triangle. Then likewise I subtract the lesse latitude as 52 out of 58, the residue will be 6, which I make the other side of my Triangle, which done, I multiply 6 in it selfe, and it makes 36, which is the square of one side: Then I multiply 5 in it selfe, and the product will be 25, the square on the other side. These two squares added together by the foresaid Proposition must be equall to the square of the Hypotenuse, or third side 61, whereof the square root being extracted, will shew the side it selfe, which will be 7½, which is the distance: If any man desire to know this distance according to miles, he must reduce the degrees of longitude and latitude into miles according to our former rules, before he begin to worke: because

because (as we have shewed) the degrees of longitude being measured in the Parallels are not alwayes equall, the Parallels being somewhere greater, somewhere lesser. This way must needs bee more exact, in that a Mile is a smaller part then a Degree, and (as *Pitiscus* notes) the Fractions which fall out in extraction of roots can hardly bee reduced to any proportion. Nevertheless this way of finding out the distance by a Right-line Triangle, how soever common and received, is very vnperfect and subiect to great error, especially in places far distant: for as much as it supposeth the Meridians with the Parallels on the Globe to make true squares, whereas indeed all the Meridians meet in the pole, and so by consequence cannot make true squares: But yet this error is far lesse in a lesser distance; because in a small space of earth, the roundnesse and conuexity of the Earth is insensible, or at least of very small importance: so that this way cannot be altogether vnusefull.

12 Another is found out more exact then the former by the tables of *Signes*, *Tangents*, and *Secants*. This is performed by finding out the numbers: whereof the former is called *Inuentum primum*, or the first found number. The second *Inuentum secundum*, or the second found number. The working, of which Probleme depends on these rules.

- 1 Multiply the Right Signe of the difference of the longitude into the summe of the complement of the lesser latitude, and diuide the product of that multiplication by the totall summe, & then by the rules of *Signes* and *Tangents* the Arch of that Quotient found out will giue the first found number.

R 4

2 Mul.

- 2 Multiply the right signe of the lesser latitude by the totall signe, and hauing diuided the product thereof by the signe of the complement of the first number, subtratt the Arch of that quotient out of the greater latitude which giues the second found number.
- 3 Then multiply the signe of the complement of the first found number into the signe of the complement of the second found number, and hauing diuided the product by the Totall Signe, Let the Arch of the quotient be sought out by the Tables, which Arch subtracted out of the whole quadrant, will giue the degrees of a distance in a great circle.

To expresse the practice and manner of working according to our former Rules, we will suppose the two cities, whose distance is here sought out to be *Ierusalem* and *Norimberge* in *Germany*. *Ierusalem* hath in longitude 66. degrees. 0. min. and in latitude 31 degrees, 40. minutes. Againe *Norimberge* hath in longitude 28. degrees. 20. minutes, and in latitude 49 deg. 40. min. The difference of their longitude is 37. deg. 40. minutes. The right signe whereof is 36664: (for here wee make 60000 to be the totall signe, rejecting the two last figures on the right hand in the tables of *Regiomontanus*.) Now you must multiply 36664: into the signe of the Complement of the lesser latitude, which is 51067: the product of which two signes being multiplied the one by the other, there will arise 1872320488: which if you diuide by the totall signe 60000, the quotient will giue you 31205, whose Arch is 31 deg. 20 min. and this must be your first found Number.

For the finding of the second Number, you must proceede in this maners: Multiply the right signe of the lesser latitude, which

is 31498 by the totall signe 60000, and the produ't will bee 1889880000: which summe, if wee diuide by the signe of the Complement of the *first-found* Number, which is 51249, wee shall finde in the quotient 36876; the Arch whereof is 37 degrees, 55 min: which Arch subtracted out of the greater latitude, there will remaine 11 degrees, 29 min: and this is our *second-found* Number. These things thus supposed to bee found out, wee must multiply the fore-said signe of the Complement of the *first-found* Number, which is 58798, and the product will arise to 3013338702, the Arch whereof is 56 deg. 50 min: which being subtracted out of the whole quadrant, viz: 90 degrees, there will remaine 33 degrees, 10 min: of the greater circle. These 33 degrees if we multiply by 60, there will arise 1980 miles, whereunto if we finde the 10 miles answerable to the 10 min. wee shall finde the distance betwixt these places to be 1990 Italian-miles. This example is vsed by *Appian*, and wrought according to his owne Tables, and farther explained by our countryman *Blunden* in his Exercises. The same way of working hath been deliuered by *Clavius*, *Juntlinus*, and others, although not according to the same Tables. This way of measuring the distance by the *Signes* and *Tangents* according to these Authors, may be warranted more exact than the other, because it admits of smaller parts in the calculation; yet will it come far short of truth.

10 Another way of finding out the Distances of places, differing both in longitude & latitude, is by the Resolution of a Sphericall triangle.

This way of all the rest must needs be most certaine: for as much as this kind of triangle best expresseth the sections of the Globe. The methode of which working I finde no-where better taught then in *Piriscus* his *Trigonometry*: of whose ingenious industry notwithstanding little vse can bee made, except the Learner first acquaint himself with his principles, because in his *Geographicall Problemes* he briefly referres his Reader to his former grounds and *Axiomes*, accurately demonstrated in his former books: For mine owne part it might perhaps seeeme as absurd in this Treatise,

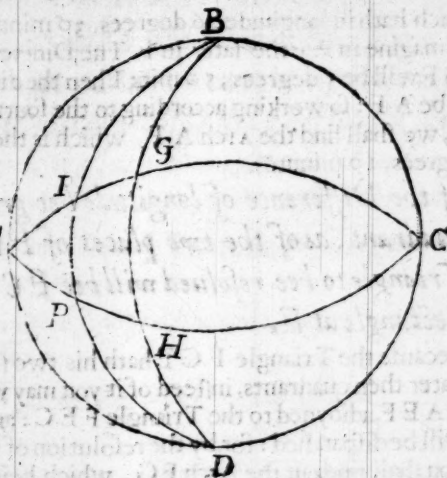
tise, to intermixe all his preparatory demonstrations; being meere *Geometrical*, and without the limites of my subject, as by leaving out so necessary a way to mangle my discourse. Wherefore intending a middle way, I will (God-willing) in such sort set downe these propositions, that I may giue some light to this excellent inuention, and referre my Reader to *Pitiscus* his *Axiomes* for farther Demonstration.

14 The Distances proposed to be measured by Sphericall triangles, admit of two cases: 1 When two places are so situate, that the one is vnder the *Equatour*, the other without. Secondly, when both are without the *Equatour*.

15 The former againe is three-fold: For either the difference of longitude betwixt those places is *Equall* to a quadrant, or *Lesse*, or *Greater*. The seuerall wayes of inuention shall bee directed by these Rules.

1 If the Difference of longitude be *Equall* to a quadrant, the distance will also be a quadrant.

As for example in this present figure wee will imagine the circle A B C D. to bee the first Meridian: the places whose distance is sought out A and G: whose Distance A G will bee a quadrant. For A will be a pole of a Greater Circle B G D, by the 56 prop. of the 1 of *Pitiscus*: wherefore all the Arches drawne from thence to B G D will bee quadrants by the same proposition. For a more familiar instance wee will take the Iland *Sumatra*, which hath in longitude 131 degrees, but no latitude, being sited vnder the *Equatour*: and the city *Buda* the *Metropolis* of *Hungary*, which hath in longitude 41 degrees, in latitude 47 degrees; The difference of longitude is 90 degrees; for 41 being



ing subtracted out of 131, there will remaine 90, wherefore the distance betwixt those places will be 90, which being multiplied by 60, will produce 5400 Italian-miles.

2 If the difference of longitude bee lesse then a quadrant as *A F*: the Triangle *AEF* here is to bee resolved into his parts, according to the 4th Axiome of Pithiscus.

As for example the places, whose longitude is here sought out, shall be *A* and *F*; The Triangle here to be knowne is *AEF*; whose Resolution depends on our Authors 4th Axiome. For the Difference of longitude is *ABF*; because the measure of a Spherickall Triangle being taken in a great circle, is an Arch of a greater circle, described from the Angular point, and comprehended betwixt the two legges of the Triangle so farre as a quadrant, as is taught in the 58 proposition of his first Booke. For a more speciall instance we will take two places; whereof the one shall bee the Iland of *S. Thomas* before mentioned, which hath in longitude 32 degrees and 20 minutes. The other *Amsterdam* in Hol-
land

land, which hath in longitude 26 degrees, 30 minutes. The former we imagine in A; the later in F. The Difference of longitude A B F will be 5 degrees, 50 min: Then the distance sought out must be A F: so working according to the fourth Axiome of *Pitiscus*, we shall find the Arch A F, which is the distance, to be 54 degrees, 19 minutes.

3 If the Difference of longitude bee greater then a quadrant, as of the two places of F and C, the Triangle to bee resolved will bee F C E, being a Rectangle at E.

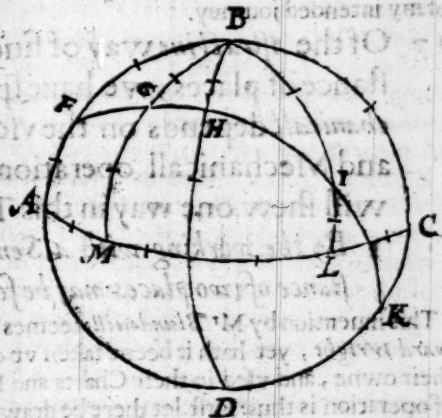
Here because the Triangle F C E hath his two sides F C, and E C, greater then quadrants, instead of it you may worke on the Triangle A E F, adioyned to the Triangle F E C: and the whole worke will be dispatched: for by the resolution of the Triangle A E F, you shall find out the Arch F G, which being added to the quadrant C G, there will be produced the Arch F C, which is to be sought out. As for example, we will imagine *Heidelberg* as it were placed at F, to haue in longitude 30 degrees, 45 minutes, in latitude 49 degrees 35 min: Then wee will suppose *Summatra*, as placed at C, to haue in longitude 131 degrees, but no latitude: The difference of longitude will be E C, of 100 degrees, 15 minutes: and the complement A E 79 degrees, 45 minutes. Then working according to the Rules of *Trigonometry*, we shall find the signe of the Arch F C, to be 6 degrees, 37 $\frac{1}{2}$ minutes; which being added to F C, being 99 degrees, will produce 96 degrees, 37 $\frac{1}{2}$ minutes, to which Arch there will answer 1449 German-miles.

16 The second Case is, when both places are situate without the Equatour: This is againe twofold: For either the two places are vnderstood to be situate towards the same Pole, or else one place toward the Northerne, the other

other towards the Southerne Pole. Both which Cases shall be taught in these Rules.

1 If both places whose distance is sought, be situate towards the same Pole, there will arise a Triangle, whose sides and Angles will be knowne by the fourth Axiome of Pitiscus in Trigonometry the fourth Booke:

As for example, in this present figure, let the two places given be $F G$, the Triangle to be knowne, will be $F B G$, whose acute Angle will be at B . Let the places given be as $F H$; the Triangle to be resolved & known will be $F B H$, having a right Angle at H . Finally, if the places supposed to be given, are as $F I$, the Triangle to be knowne will be $F B I$, with an obtuse Angle at I .



2 If the one place be situated towards the North-pole, and the other towards the South-pole, there will arise a Triangle, whereof the one side about the Angle which is given, will be greater then a quadrant.

As in the former figure, let the places given be as G and K , also

so H and K, also I and K: There will still fall out a Triangle, whose one side containing the Angle giuen, will be greater then a quadrant, as BK: wherefore for the side BK, you must take his complement to the Semi-circle BF, that is, for the Triangle GBK, you must worke by the Triangle GBF: and instead of the Triangle HBK, you must take the Triangle HBF: and for the Triangle IBK, you must worke by the Triangle IBF, according to the fourth Axiome of the fourth booke of *Piriscus*, to which I had rather referre my Reader, then intermixe our *Geographicall* discourse with handling the Principles of *Geometry*, which here are to be supposed so many precedent propositions; which, expressed as they ought, would transcend the bounds of my intended journey.

17 Of the *Astrattine* way of finding out the Distance of places, we haue spoken: The *Mechanicall* depends on the vse of Instruments and Mechanicall operation, whereof wee will shew one way in this Theoreme.

1 By the working with a Semi-circle, the Distance of two places may be found out.

This inuention by Mr *Blundenill*, seemes to be ascribed to *Edward Wright*, yet hath it beene taken vp of forreine Writers as their owne, and vsed in their Charts and Mappes. The manner of operation is thus: First, let there be drawne a semi-circle vpon a right *Diameter* signed out, will be the letters ABCD, whereof D shall be the center, as you find it deciphered in this present figure. The greater this *Semi-circle* be made, so much the more easie will be the operation; because the degrees will be larger. Then this *Semi-circle* being drawne, and accordingly diuided, imagine that by the helpe of it, you desire to find out the distance betwixt *London* and *Ierusalem*, which cities are knowne to differ both in *longitude* and *latitude*. Now, that the true distance betwixt these two places may bee found out, you must first subtract the lesser *longitude* out of the greater, so shall you finde the Difference

Difference of their longitudes, which is 47 degrees. Then reckon that Difference vpon the *Semi-circle*, beginning at A, and so proceed to B; and at the end of that Difference, make a marke with the letter E, into which point by your Ruler, let a right line be drawne from D the center of the *Semi-circle*. This being in this sort performed, let the lesser latitude be sought out, which is 32 degrees in the foresaid *Semi-circle*, beginning your accompt from the point E, and so proceeding towards B, and at the end of the lesser *latitude*, let another point bee marked out with the letter G: from which point let there be drawne a perpendicular, which may fall with right Angles vpon the former line, drawne from D to E; and where it chanceth to fall, there marke out a point with the letter H: This being performed, let the greater *latitude*, which is 51 degrees, 32 minutes, be sought out in the *Semi-circle*, beginning to reckon from A towards B, and at the end of that latitude, let downe another point, signed out by the letter I: from whence let there bee drawne another perpendicular line, that may fall with right Angles vpon the *Diameter* A C, and here marke out a point with the letter K: This done, take with your Compasse the distance betwixt K and H; which distance you must set downe vpon the *Diameter* A C, placing the one foote of your compasse vpon K, and the other towards the center D, and there marke out a point with the letter L: Then with your compasse take the shorter perpendicular line G H, and apply that widetesse vpon the longer perpendicular line I K, placing the one foot of your compasse at I, which is the bounds of the great *latitude*, and extend the other towards K, and there make a point at M. Then with your compasse take the distance betwixt L and M, and apply the same to the *semi-circle*, placing the one foot of your compasse in A, and the other towards B, and there marke out a point with the letter N. Now the number of degrees comprehended betwixt A and N, will expresse the true distance of the two places, which will be found to be 39 degrees: which being multiplied by 60, and so conuerted into miles according to our former Rules, will produce 2340, which is the distance of the said places.

17 The expression of the Distance of two places may be performed either by the *Globe* or *Map* according to these Rules.

1 The distance betwixt two places in the *Globe*, being obserued by the quadrant of *Altitude*, and applied to the degrees of the *Equatour*, or any great circle, will shew how many miles such places are distant.

The practise hereof is very easie, as shall be taught in this example: we wil for instance take *Toledo* in the middest of *Spaine*, and the *Cape of Good Hope* in the *South* Promontory of all *Africa*: The space taken by a quadrant of *Altitude*, or any threed applied to the *Equatour*, will be found to bee about 82 degrees, which being multiplyed by 60, and so converted into miles, will render 4920, the true distance betwixt these two places.

2 The distance betwixt any two places in the *Chart*, obserued by a compasse, and applied to the degrees of a greater Circle, will shew how many miles such places are distant one from the other.

For an example, we will take the city *Seuill* on the *Southmost* part of *Spaine*, and *Bilbao* on the *North* side: the space betwixt those places being taken with a threed or a compasse, and applied to one of the greater Circles, will containe about 6 degrees, which being multiplyed by 60, and so converted into *Italian* miles, will produce 360: and so many miles those Cities are to be esteemed distant the one from the other.

The end of the first Booke



GEOGRAPHIE

THE SECOND

BOOK E.

CONTAINING
the generall Topicall
part thereof,

By NATHANAEL CARPENTER, Fellow of
Exceter Colledge in Oxford.

GENES. I. vers. 10.

*And God called the Dry-land, Earth; and the gathering together of
the waters called the Seas: and God saw that it was good.*



OXFORD,

Printed by John Lichfield, for Henry Cripps, and are to be sold by
Henry Curteyne. Anno Domini, M. DC. XXXV.

GEOGRAPHIE

THE SECOND

BOOK

CONTAINING

the General Topical

part thereof

FRANCIS CARPENTER, Fellow of
Exeter College in Oxford.

С. И. В. С. И.

the history called the Seas; and God the Lord is our God.



OXFORD

Library of Congress
George Washington University
Washington, D.C. 20057



TO THE
RIGHT HONOVABLE
PHILIP,
EARLE OF

MONTEGOMERIE &c.

*Knight of the most Noble order of the
Garter, and Steward of the famous
Vniuersity of Oxford.*

Right Honourable,



His Geographickall Treatise consisting of two parts, was in the very birth in such sort consecrated to your inestimable Brother, as notwithstanding it so farre reserved it selfe to awaite your Honours fauour, that Both may seeme, as to share a part, so to chal.

THE EPISTLE

challenge the *whole* in my poore *Industrie*. The Soule of man which some Philosophers imagine, to be *all in all*, & *all in euery part*, seemes to me no where better resembled then in your Generous *Fraternity*; wherein the Soule of *Heroicall Magnificence*, though *Indiuided* in it selfe, so *entirely* communicates herselfe to either, that both may seeme at once to *enjoy* her presence while neither *want*. If this my bold attempt in presenting to your Honours hands these vnworthy labours, without any former reference, might be interpreted intru-
 sion, it were enough for *Ingenuity* to pretend, that your generous loue vnto our poore *Colledge* and the respectiue duty wherein the *Colledge* alwayes stands obliged vnto your *Honour*, commands my pen beyond *manners* or *ability*. Your affection to our *house*, could no way expresse it selfe ampler then by trusting our custody, **with the charge of**
 R. L^d. D. your choicest Iewell: A *Gentleman* of that tow-
 ardly wit and sweet *disposition*, that *Learning* and *Morality* commonly reputed the daughters of *time*, seeme in him scarce beholding to *yeeres*, and to challenge a precedency before *experience*; in so much that our ancient *Mother* markt out with all the Characters of age and declining *weaknesse*,
 cherishing

DEDICATORIE.

cherishing in her bosome this young darling,
seemes to resume her *youthfull* habit, and triumph
ouer *Time* and *Ruines*. This happines amongst
diuerse others vouchsafed by your Honour to the
place, for whose good opinion the best part of
mine endeouours stand engaged, hath encoura-
ged my *hopes* to promise me your indulgent Ac-
ceptance of this slender piece, long since inten-
ded and deuoted, as my selfe, vnto your seruice:
In which confidence, fearing any longer to tres-
passe on your serious and high imployments *en-*
debted to your King and Countrey, I humbly
rest

*Your Honours in all duty and
seruice to bee commanded*

NATHANAEL CARPENTER.



A TABLE OF THE SEVERALL
Contents of the second Booke of Geo-
graphy, according to the
Speciall Theoreme.

C H A P. I.

Of Topography and the Nature of a place.

- 1 The Terrestriall Sphære is euery-where habitable. pag. 4
- 2 All places of the Earth haue suffered manifold mutation
and changes, as well in name as nature. pag. 6
- 3 Places hauing long continued without habitation, are seldome
so healthy and fit for dwelling, as those which haue beene in ha-
bited. II.

C H A P. II.

Of the generall Adiuncts of places.

- 1 The manner how to measure the magnitude of a Region by the
Diameter, both according to breadth and length. 15.
- 2 Of the measuring of a Countrey by the circuite of it. 17.
- 3 The Measuring of a Countrey by the circuite is deceitfull, and
subiect to great errour. 17.
- 4 Those Regions are more exactly measured which partake of a
plaine surface. 19.
- 5 How Countries are bounded. 20.
- 6 Naturall bounds are more certaine then Artificiall. ibid.
- 7 Equall.

- 7 Equall bounds containe not alwaies equall Regions. 21
- 8 Of the quality of a Region. *ibid.*
- 9 Speciall places are endowed with speciall Tempers and dispositions. 21
- 10 Of the magneticall affections of a place, as Variation and Declination. 26
- 11 The magneticall variation is of no use for the first finding out of the longitude: yet may it serue to good purpose for the recognition of a place before discovered. 27
- 12 The declination of a place being knowne, the latitude may bee found, yet not without some error. 29
- 13 Of the externall Adiuncts of the Aire belonging to a place. *ibid.*
- 14 The disposition of the Aire Adjacent to a place depends chiefly on the Temperament of the soile. 30

C H A P. III.

Of the Adiuncts of a place in respect of the heauens.

- 1 Places according to their diuerse situation in regard of the Heauens are diuersely affected in quality and constitution. 34
- 2 Of the diuision of the Earth into the North and South Hemispheres. 38
- 3 Northerne and Southerne places alike situate generally enioy a like disposition. 39
- 4 The Northerne Hemisphere is the masculine, the southerne the feminine part of the Earth. 40
- 5 Of the diuerse sections of the Hemispheres and the seuerall qualities belonging to them. 43
- 6 Of the East and West Hemispheres. 51
- 7 The Easterne Hemisphere is happier then the other. 52
- 8 The difference of the East and West cannot worke any difference in two places, by any diuersity of the heauens. 53
- 9 Of the subdiuision of the Easterne and Westerne Hemispheres. 54
- 10 Places situate towards the East in the same latitude are better then those places towards the West. *ibid.*

C H A P.

C H A P. IV.

Of the manner of Expression and Description of Regions.

- 1 *Of the finding out of the Angle of position by some dioptricke
Instrument at two or more stations.* 57
- 2 *At one station by optick observation to find out the situation of
one place in respect of the other.* 59
- 3 *Of the manner of translation of Regions into the Chart.* 61
- 4 *To set downe the Meridians and Parallels in a particular
Chart.* 62
- 5 *How to set downe Cities, Castles, Mountaines, Rivers, &c. in
the Chart.* 64
- 6 *Of the fabrickes of the scale of miles in the Chart.* 65
- 7 *The use of the scale of miles set downe in the Chart.* *ibid.*

C H A P. V.

Of Hydrography, and the absolute aduants of the
Sea; of the figure and quality.

- 1 *Although the whole body of the water be sphericall, yet it is pro-
bable, that the parts of it incline to a Conicall figure.* 70
- 2 *The water of the sea is salt, not by Nature but by Accident.* 75
- 3 *Seas absolutely salt, are neuer frozen.* 79
- 4 *The Water of the sea is thicker then the other Water.* 80

C H A P. VI.

Of the motions of the sea.

- 1 *Of the ebbing and flowing of the sea and the causes thereof.* 82
- 2 *All seas doe not ebbe and flow alike, nor the same at all
times.* 92
- 3 *It is probable that the sea is carried some-where from East to
West, and some-where from North to South, & contrariwise.* 98
- 4 *Of the violent motion of the sea caused by windes.* 101
- 5 *To some certaine places at certaine times belong certaine
winds.* 102
- 6 *The violence of the winds makes the sea sometimes in some places
transcend his ordinary bounds.* 103

CHAP.

C H A P. VII.

Of the Depth, Situation, and Termination of the sea.

- 1 *The ordinary depth of the sea is commonly answerable to the ordinary height of the maine land above the water: and the Whirlpooles & extraordinary depths, answer to the height of the mountains above the ordinary height of the Earth.* 104
- 2 *The superficies of the sea is some-where higher then the superficies of the Earth: some-where lower.* 109
- 3 *The sea in respect of the Earth is higher in one place then another.* 111
- 4 *The Water is so divided from the dry-land, that the quantity of water is greater in the Southerne Hemisphere, of land in the Northernne.* 115
- 5 *The whole Globe of the Earth is environed round with sea betwixt East and West.* 116
- 6 *It is probable that the Earth is environed round with water from North to South: Of the North-west passage,* 117

C H A P. VIII.

Of Sea Trafficke and Merchandice.

- 1 *Navigation first taught by Almighty God, was afterwards seconded by the industrie of famous men in all ages.* 132
- 2 *Navigation is very necessary as well for the increase of knowledge as riches.* 135

C H A P. IX.

Of Pedography, Rivers, Lakes, and Fountains in the Earth.

- 1 *All Rivers haue their originall from the sea the mother of rivers.* 143
- 2 *All Rivers and Fountains were not from the beginning.* 155
- 3 *Many rivers are for a great space of land swallowed up of the Earth: whereof some after a certaine distance, rise againe.* 156
- 4 *Rivers*

- 4 Rivers for the most part rise out of great mountaines, and at last by diuerse or one Inlet are disburthened into the sea. 157
- 5 Diuerse Fountaines are endowed with diuerse admirable vertues and operations. 159
- 6 Places neere great Rivers and Lakes, are most commodious for Habitation. 162
- 7 Of Lakes and their causes. 162
- 8 It is probable that some Lakes haue some secret intercourse with the sea under ground. 163

C H A P. X.

Of Mountaines, Vallyes, plaine-Regions,
woody and champion Countreyes.

- 1 Mountaines, Vallyes, and Plaines, were created in the beginning, and few made by the violence of the Deluge. 165
- 2 The perpendicular height of the highest mountaines seldome exceeds 10 furlongs. 169
- 3 The ordinary height of the land above the sea in diuerse places is more then the hight of the highest mountaines above the ordinary face of the Earth. 171
- 4 Mountaines Countreyes are commonly colder then plaine. 172
- 5 Mountaines since the beginning of the world haue still decreased in their quantity, and so will vnto the end. 174
- 6 Of Woods and their nature. 178
- 7 Woods are not so frequent or great as in ancient times. 179
- 8 Places moderately situate towards the North or South-pole, abound more in woods then neere the Equatour. 180

C H A P. XI.

Of Islands and Continents.

- 1 It is probable that Islands were not from the first beginning, but were afterwards made by violence of the water. 184
- 2 Peninsulas by violence of the sea fretting through the Isthmus, haue oftentimes turned into Islands, and contrariwise: Peninsulas by diminution of the sea made of Islands. 189

C H A P.

CHAP. XII.

Of Inundations and Earth-quakes.

- 1 No vniuersall Inundation of the Earth can be naturall: the whether may depend from naturall causes. 193
- 2 Particular alterations haue happened to the bonds of Countries by particular Inundations. 195
- 3 Certaine Regions by reason of great Riuers are subiect to certaine anniuersary Inundations. 197
- 4 Regions extreame cold or extreame hot, are not so subiect to Earth-quakes as places of a middle temper. 201
- 5 Hollow and spongie places are more subiect to Earthquakes then solide and compacted Soiles. 202
- 6 Ilands are more often troubled with earth-quakes then the continent. 203

CHAP. XIII.

Of the Originall of Inhabitants.

- 1 All Nations had their first originall from one stocke, whence afterwards they became diuided. 206
- 2 The first inhabitants of the Earth were plantèd in Paradise and thence translated to the places adioyning. 208
- 3 The first plantation of Inhabitants immediately after the Deluge beganne in the East. 213

CHAP. XIV.

Of the disposition of Inhabitants in respect of the site.

- 1 The people of the Northerne Hemisphere, as well in Riches, and Magnificence, as valour, science, and ciuill gouernment, surpass the people of the south Hemisphere. 221
- 2 The extreame Inhabitants toward the pole, are in complexion hot and moist: Those towards the Equatour, cold and dry, those of the middle partaking of a middle temper. 226

- 3 The extreame Inhabitants towards the poles are naturally enclined to Mechanicall workes and martiall endemours; the extreame towards the Equatour, to workes of Religion and Contemplation: The middle to lawes and civility. 232
- 4 The people of the extreame Regions towards the poles in Martiall promesse haue commonly proved stronger then those neerer the Equatour: but the middle people more provident then either in the establisment and preservation of commonwealths. 236
- 5 The extreame Regions, in Manners, Actions, and Customes, are cleane opposite the one to the other: The middle partake a mixture of both. 239
- 6 The people of the Easterne Hemispheare in science, Religion, Civility, and Magnificence, and almost in euery thing els, are farre superiour to the Inhabitants of the Westerne. 250
- 7 The Westerne people haue beene obserued to be more happy, and able in Martiall discipline; the Easterne in witty contemplation and contemplatiue sciences. 252
- 8 The Easterne part of the Westerne Hemispheare was peopled before the Westerne. 255.

C H A P. XV.

Of the Diuersity of dispositions in regard
of the Soile.

- 1 Mountaine-people are for the most part more stout, warlike, and generous, then those of plaine Countries, yet lesse tractable to government. 256.
- 2 Windy Regions produce men of wild and instable dispositions: But quiet Regions, more constant and courteous. 273.

C H A P. XVI.

Of the dispositions of Inhabitants, according
to their originall and education.

- 1 Colonies translated from one Region into another farre remote retain.

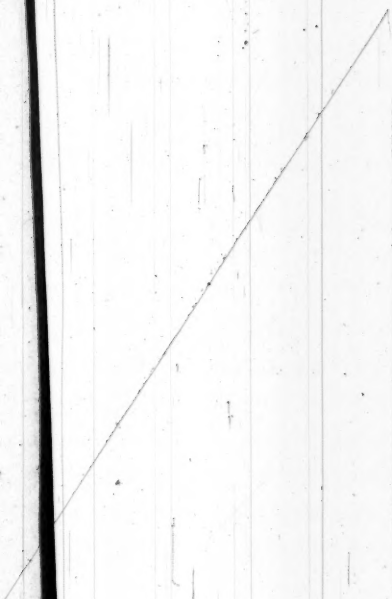
retaine a long time their first disposition, though by little & little,
they decline and suffer alteration. 278

2 The mixture of Colonies begets the same Nation a greater dis-
parity and variety of the Nations amongst themselves. 278

3 Education hath a great force in the alteration of Naturall dispo-
sitions: yet so as by accident remitted, they soone returne to their
proper Temper.

4 By Discipline, Nations become more wise and Politicke in the
preservation of states, yet lesse stout and courageous. 283





Top
by
ng
mp
E
h d
no
Dap
kth

The Analysis of the second Booke.

Earth it selfe : which are Internall or Externall: Common or Magneticall, whereof Chapter 2.

Adjuncts and proprieties: these agree to a place in respect of the

Generall, which of a place generally taken, without any speciall division handles the

Heavens: which are Generall or Speciall. Chap. 3.

Expression and Manner of Description of Regions, aswell in the finding out the Angle of position, as Translation of places formerly found out into the Globe or Chart. Chap. 4.

Absolute, such as agree to the Sea without any comparison of it with the Land: Here we observe in the water of the Sea

1 The Figure, and Quality. Chap. 5.

Internall, which are imbred in the Nature of the Sea; which againe are either

2 The Motion, Naturall and Violent. Chap. 6.

Comparative, which concerne the Depth, Situation, and Termination of the Sea. Chap. 7.

Sea: whose description is called Hydrography, in which we are to consider the Adjuncts of the Sea, which are either

Externall, which concerne Sea-Trafficke and Marchandize. Chap. 8.

Speciall, which contains the distinction of a place into

Naturall, which are againe divided into

Perpetuall, such as ordinarily agree to the earth: these againe are either

Absolute, wherein we have no respect vnto the Sea: Here we consider the Nature Comparative wherein we consider the Termination of the Sea with the Land. Chap. 11.

1 Of riuers, fountaines, and lakes. Chap. 9.

2 Of mountaines, vallies, and plaine-Regions, woody, and champion Countreys. Chap. 10.

Land, which we terme Pedograghy, whose Accidents are either

Casuall, which seldome fall out, such as are Inundations and Earth-quakes. Chap. 12.

Ciuill, which concernes the Inhabitants of any place, in whom we consider the

Originall or off-spring. Chap. 13.

Disposition which is varied, either according to the

1 Site in respect of the Heavens. Chap. 14.

2 Soyle. Chap. 15.

3 Originall, or Education. Chap. 16.

Place this Analysis after * *

Topography containing a description of the Earth as it is divided into places Chapter 1. & further



GEOGRAPHIE:

THE SECOND BOOKE.

C H A P. I.

Of Topographie and the nature of a place.

IN the former Treatise, by Gods assistance, wee haue treated of the *Sphericall* part of *Geographie*: It will in the second place seeme conuenient to speake of the *Topicall* part of it.

2 The *Topicall* part teacheth the description of the *Terrestriall* Globe, so farre forth as it is diuided into places.

The nature of *Topographie*, whereof we are to treat in this second part, is discouered vnto vs, not only in the name, which promisseth a description of places, but also in the differences set downe by *Protony* himselfe, betwixt the *Sphericall* and *Topicall* part: the former of which hee calls *Geographie*, and later

ter *Topographie*; whereof wee haue spoken at large in the first Chapter of our former booke. Here onely wee will note this one distinction, that *Topographie* may bee taken either more generally, or specially: Generally we may take it so farre forth, as it discouers vnto vs either the whole world and all his parts, or at least some great and principall parts; such as is an *Empire*, *Region*, *Kingdome*, or such like. More specially and particularly, it hath vsually beene taken for the description of a very small place, whose situation in respect of the heauens is not noted, but of the parts one to the other: such as are *Cities*, *Burrowes*, *Townes*, *Castles*, *Lakes*, and *Riuers*. The former (whereat wee chiefly aime) cannot well bee performed without the vse of the *Sphericall* part: The latter we will more sparingly touch, being an infinite taske in the whole earth to descend to all particulars which come in our way: yet shall wee not altogether omit or neglect such circumstances in their due places, so farre forth as wee can; leauing the rest to such *Topographers*, who spend their stocke in the description of some particular place or *Region*: whereof this our Age hath produced many deserving high commendations. This Science was anciently adorned by *Homer*, *Anaximander*, *Milesius*, *Hecataeus*, *Democritus*, *Eudoxius*, *Dicaearchus*, *Euphorus*, as wee finde in *Straboes* first booke: to which afterward succede, *Eratosthenes*, *Polybius*, *Possidonius*, and diuers others. Which part requires little or small knowledge in the Sciences *Mathematicall*, but challengeth more affinity with the *Physicall* and *Politickall* part of *Philosophie*; and therefore is more subiect to popular vnderstanding then the former, and may without it, afford some profit to the Reader.

3 **The Topicall part** is either generall, or speciall:
The generall is that which handles the generall Adiuncts of a place.

4 A place is a superficial space of the Terrestrial Globe, fitted for habitation.

To the constitution of a place (as it is here *Topographically* taken) there ought to be a concurrence of two things, which we may call Matter and Forme. The Matter is the space contained; or superficiall platforme of the earth whereon wee dwell. The forme is the capability or aptnesse of it for habitation; both which concurring together are conceiued to make a place, such as wee here *Topographically* vnderstand: for here wee vnderstand not a place *Physically*, for the receptacle of a naturall body; in which sense the Heauens and all the elements are said to haue their naturall places: Neither yet *Geometrically* for a plaine whereon a line or figure may bee drawne: but *Topographically* for the vpper face of the earth whereon people or other liuing creatures may inhabite. This place as appears by reason and holy Scriptures was more ancient then habitation. For whereas in the first Masse the earth was inuoloped with waters on euery side, affording no place for dwelling; Almighty God is said afterwards to haue separated and parted the waters from the dry land, making the one a Receptacle for Fishes, and such creatures of the deepe, the other for a dwelling place for mankind, and such creatures as breath vpon the land: yet hath hee so provided in his diuine wisdom, that neither the Inhabitants of the land can well want the Sea, nor the liuing creatures in the Sea want the land. The one appears in that wee are enforced to make vse of the sea, not onely for Food and nourishment, whereof a great part consisteth of fish: but also for our Traffique and commerce with forraine Nations, which is better effected by Sea then Land-voyages. The latter is as easily shewed, in that the fishes of the Sea deriue not onely their composition, but also their proper nourishment from the land: whereof wee shall haue more occasion to speake hereafter. Now wee are moreouer to consider, that a place may bee taken in a double sense: first more largely for any place wherein a creature may line for longer or shorter time. Secondly, more strictly for such a space of earth, whereon mankind may conveniently reside or dwell. The former comprehends not onely the land, but also the water; for experience shewes, that men in ships may for a time reside and dwell on the backe

of the maine Ocean. But the latter betokening a continuance of habitation, is onely agreeable to the land: Which sense howbeit it be more consonant to the common vse of speech, yet for methode sake, wee are inforced to vse the former: vnderstanding by habitation, not onely a place of conuenient residence, but any other whereon a creature for a time may breathe and liue.

1 *The Terrestriall Spheare is euerywhere habitable.*

It was an ancient opinion (as we haue formerly touched) that the earth was not euerywhere habitable: namely, in the *Intemperate Zones*, whereof the one was placed in the middle of the earth, the other at the endes: the former was thought not habitable by reason of the extremity of heat; because the Sunne-beames there fall perpendicularly, and so make a greater reflection; The other for extremity of cold, by reason of the obliquity of the Sunne-beames, causing little or no reflection: whence a second cause seemes to be drawne from the extreame drought of those places, which seemes most opposite to mans temper, requiring a reasonable degree of moisture. But notwithstanding these reasons of the ancients, it must needes bee confessed as an vndoubted truth, confirmed by experience of many Nauigatours, that those Regions by them imagined unfit for habitation, are not onely habitable, but in many places very populous. Neither want there many reasons found out by latter writers, to mitigate the rigour of this opinion: some whereof wee haue already touched in our former treatise. First, whereas they vrge the places vnder the Equinoctiall to bee vnhabitable by reason of intemperate heat; wee may easily answer, that the dayes and nights are then alwayes equall, containing not about 12 houres, so that the space of either being shorter, the cold of the night may well aswage the extreame heat of the day. Another reason is ordinarily taken from the extraordinarily high mountaines, commonly placed vnder the Equinoctiall, which approaching neerer the middle Region of the aire, must of necessity partake somewhat more

of

of cold : which dayly experience can witnesse, in that their topes are couered with snow euen in the depth of Summer. Thirdly, the neerenesse of the maine *Ocean* to a great part of this Region, is a great cause of this cold temper, because water is found to bee by nature cold. Fourthly, the set and certaine windes by nature ordained to blow in the hottest times of the yeere, may adde much to temperature. Fifthly, the extraordinary Raines and showers which those places suffer, which are vnder the Line, especially when the Sunne is verticall, are a great cause of the asswaging of the heat of the Sunne. Lastly, the custome of the Inhabitants being from their cradles inured to no other quality or disposition of the ayre, will take away much from our admiration. On the other side no small reasons may bee shewed, why, the Regions lying neere or vnder the *Pole* should not bee so extreemely cold, but that they may admit of habitation. First, because the Sunne being for six moneths together aboue their Horizon, must needs presse into the Ayre more heat then otherwise it would doe. Besides, the thicknesse incorporated (as it were) with heat, must needs receaue into it more degrees of it then a thinner and more refined ayre, because the intention of the quality most commonly supposeth the condensation or thickning of the subject wherein it is. But no greater reason can bee shewed in this point then the custome of the Northerne inhabitants, exposed from their infancy to no other temperament. If wee should aske a reason why wee vnmaske our faces against the encounter of the greatest cold, being a soft and tender part, not daring to vncover our other parts, what reason can a man inuent but custome? If any should aske why barbarous people liuing in farre colder climates then this of ours, goe altogether naked, whereas the cold is mother of many diseases amongst vs who goe alwayes clothed; onely vse and custome can yeeld an answer. These reasons make it probable enough, that no place of the whole world is by nature made not habitable. Now that it is not onely inhabitable by nature, but also for the most part truly inhabited, will appeare as easily, if wee trust the testimony of Nauigatours which haue discovered few or no Regions wanting

ting some Inhabitants. But that this proposition may bee more distinctly vnderstood, wee must know that the whole world is diuided into *Sea* and *Land*: for the *Sea* we may call it habitable in that large sense before mentioned; to wit, that on it euery where men in ships may breath and liue; which is plaine out of experience of Nauigatours, who haue sailed round about the Earth from *East* to *West*, and haue entred farre towards the *North* and *South*: where at least some times of the yeere, or other they might finde the way passable: For the land which is here principally vnderstood, wee must note that it may bee considered two wayes; either for euery little quillet or parcell of land contained in the superficies of the Earth; or else for a certaine Region of some indifferent greatnesse. In the former sense, it were too much to affirme euery part of the Earth to bee habitable; for as much as many places, as the toppes of the *Alpes*, or the sands of *Africa*, properly admit of no habitation; yet in an improper and large sense they may be called habitable, because on them a man may liue and breath for a certaine space of time. But if by the parts of the land wee vnderstand some reasonable greatnesse, no great doubt can bee made, but that it is either already inhabited by mankind, or can at least admit of habitation, as that which not only for a time affords a man life and breath, but also some conuenient meanes of sustenance; for no countrey hath euer beene found so indigent and barren of all vitall aides, which is neither capeable of liuing creatures in the land, fit for mans nourishment; or that cannot draw *Fishes* from the *Sea*; or if this should faile, cannot afford *Fruits* or *Herbage* from the ground: or in case all the rest were deficient cannot haue passage by *Water* to other Countries, whence to relieue their necessities. And no question but nature hath stored euery Countrey with some commodity or other, which by trafficke may draw riches from other Regions, as by instances may more particularly appeare hereafter when wee shall speake of particular Regions, and their seuerall accidents.

2. *All places of the Earth haue suffered manifold*

fold alteration and change as well in Name as Nature.

I need not spend time to demonstrate this Assertion, for that euery place of the Earth hath beene subiect to much mutation in the proceſſe of time, as well in Nature of the *Soyle* as of the *Inhabitants*, a few obuious instances in each Countrey will easily certifie: yet will it not seeme amiſſe, I hope, to shew the progresse, manner, and causes of this alteration, which would giue no small satisfaction. To discourse of all changes according to all times were a matter infinite: Wee may referre all to two heads, to wit, the change of *Names*, and the change of *Nature*. Concerning the former that most Countreyes haue changed their first and originall names, is most euident to such as consult the Maps and writings of our common Geographers: for few or none will discouer vnto vs any Region by that name, by which it was knowne in former times: in so much, as great controuersie and dispute hath growne about diuerſe countreyes mentioned by ancient writers, whereof the name should take its first originall; but of this change we shall speake hereafter. But if we consider the naturall changes of Countries, since the first creation wee shall finde them to haue suffered as well in the naturall accidents, and disposition of the soile, as the temper of the *Inhabitants*; concerning the former wee may note a twofold alteration: whereof the one is a progresse from *Imperfection* to *Perfection*; the other contrariwise, from *Perfection* to *Imperfection*. The first groweth out of the generall Industrie of mankind, which is wont to worke euery thing as neere as it can to his best ends and vse, for his owne good and propagation of his kinde: which wee may best finde in the first originall of the world, the first ground-worke of ciuill society; for man being once expelled out of *Paradise* for his owne transgression, had left him notwithstanding for his lot the whole world besides, which no question hee found as in the cradle of Nature a poore infant, as yet altogether vnfashioned and vnshaped for humane habitation. For who can imagine the earth at that time to bee any otherwise then as a vast Wildernesse all

ouergrown with briers and bushes growing of their owne accord out of the Earth: Moreouer what *Fennes, Bogges, Marishes*, and other such incombrances could there bee wanting to those places which neuer yet felt the chastising hand of husbandrie? All these incommodities, as mankind began to multiply and propagate it selfe on the face of the Earth, were by little and little remoued, and the Earth reduced into a better forme for humane dwelling: because euery man choosing out his owne possession, began presently to till and manure the soyle with all heedfull industrie. For if our first Parents being placed in *Paradise* it selfe, the most pleasant and fertile portion of the whole world, were neuerthelesse enioyned to dresse and manure the Garden for their better vse and profit; what shall wee imagine of the other parts of the Earth, which (no doubt) a thousand degrees come short of this perfection: especially knowing this curse to bee laid on man by our Creatour: *That he should eat his bread in the sweat of his browes*; as though the earth were bound to open her treasures onely to mans paines and labour. And howsoeuer the diligence of mankind hath gone very farre in adorning and fashioning the vpper face of the earth, yet hath it not waded so farre, but that many places in our times are left altogether rude and vncultured, groaning vnder vast Wildernesses and vnprofitable desarts. For times past wee might haue for instance, gone no farther then *Britanie* and *Germanie*; both which Countreys we shall finde in these dayes to differ as much from the dayes of *Cesar*, as *Cesar* iudged them to differ from the *Roman* Territory; which no doubt hee preferred before all parts of *Europe*. Notwithstanding this generall inclination of mankind to perfect their dwelling places for their better ease and comfort, wee shall finde many wayes whereby the parts of the Earth haue degenerated, and proued more vnfit for humane habitation then in former times. The first which is the greatest, and cause of all the rest, is that *Curse* which our Almighty Creatour cast on the whole earth for *Adams* sake, which afterward seemes renewed and increased in the generall deluge, wherein all mankind suffered for their sinnes a plague of waters. For as the estate of mankind immediatly before the *Flood*

was

was farre better then that afterwards, so was the estate of *Paradise* farre better then that : So as wee may note from the beginning of the world a generall defect and weakenesse of the Creatures, still more and more declining from their originall perfection granted in the first creation. So that many great Philosophers haue coniectured, not without ground, that the world from the first creation hath suffered the change of ages sensibly, and this wherein wee liue to bee the last and decrepite age, wherein Nature lyeth languishing, as ready to breath out her last. But this opinion seemes to bee controled by reason; for as much as wee finde not a proportionall decrement and defect of naturall vigour in things, as well in man as other creatures. For if wee compare the estate of a man before the Flood, with the age of *Dauid* long after, wee shall finde a great disparity in the proportionall decrement of the *Yeeres* and *Ages* of men : for as much as many before the Flood attained to 800, and some as *Methusalem*, to 900 yeeres : But in *Dauids* time, the dayes of mans life (as he himselfe testifieth) are threescore and ten : and admit wee vnderstand this speech of *Dauid* to bee meant only of his chiefest strength and liuelyhood, wee shall yet finde a great diuersity, because man is vnderstood to bee in his greatest strength and vigour in his middle age; so that the whole age of man by this account surmounts not 140 yeeres. To which proportion of defect or decrement our times can no way agree, because many men in our dayes come neere the same age, as we see by experience, which may bee confirmed by diuerse instances, whereof wee will produce only two : the one of a certaine *Indian* presented to *Soliman* the *Turke*, being of the age of 200 yeeres : the other of the Countesse of *Desmond* in *Ireland* (which *St Walter Raleigh* mentions to this purpose) who was married in *Edward* the fourth's time, yet was aliae very lately. But to this doubt I might answer, that this extraordinary difference betwixt the ages of men, betweene the *Patriarches* and *Dauids* time compared with men, ages betwixt *Dauids* and our dayes, came from two especiall causes : First by the vniuersall *Deluge*, which caused a generall defect and decay of nature in the whole earth, the like whereof hath not since beene found:

Secondly

Secondly, it was (as it seemes) much impaired by the *Intemperance* and luxurious diet of those times, which added much to this generall weaknesse of nature: for as much as the children can haue little or no naturall perfection in themselves more then is deriued vnto them by their parents. For nothing can giue that to others which it neuer had it selfe; whence it must needs come to passe, that the posterity deriued from luxurious and distempered bodyes, should proue as weake and impotent generally (if not more) then their Parents. Now why the people soone vpon the Flood should finde their distemperature more noxious and preiudiciall to long life then the men of our age, a good reason may bee giuen; because the Earth long after the Flood had not fully receaued that naturall heat and spirit which it lost in the *Deluge*. So that all things arising out of it, as *Plants, Hearbs, Fruits*, and liuing creatures feeding thereon, proued for a while more vnwholsome and vnaturall, then in some yeeres after, when it had somewhat reuiued it selfe by the heat of the *Sunne* and the *Starre*, and by little and little returned to his owne nature. The other cause of deficiencie is more speciall, as not happening to all, but to diuerse parts of the Earth, and that more at one time then another: as the neglect of due manuring many places, caused commonly two wayes; either by contagion naturally incident to diuerse places, or by hostile *Inuasion* and deuastation: of this latter arise two maine effects; The first is the want and scarcity of Inhabitants, which should dresse and manure the ground to make it more fruitfull and accommodate to mans vse. The second is their *poverty* and *captiuitie*; whereof the one makes them vnable, the second vnwilling to effect any great matter for the benefit of the Land. A good instance whereof wee may finde in the land of *Palestine*: which in times past by God himselfe was called, *A land flowing with milke and hony*, for the admirable pleasantnesse and fertility of the Soile: yet at this day, if wee will credit travellers report, a most barren Region, deuoid almost of all good commodity fit for the vse of man, in the ruines of which, sometimes famous kingdome, euery bleere-eyed iudgement may easily read Gods curse long since denounced; Which strange alteration

teration next vnto Gods anger wee can ascribe to no other cause then the hostile inuasion of forraine enemies, which hath almost left the land waste without the natiue Inhabitants; whence it could not chuse in a short time but degenerate from the ancient fruitfulnessse. The like may we finde in all those miserable Regions which groane at this day vnder the tyranny of the vsurping *Turke*: whence a prouerbe runnes currant amongst them: *That where the Turkes horse hath once grazed, no grasse will euer after grow*: which signifies no other then the barbarous manner of the *Turkes*, hauing once conquered a land, to lay it open euer after to deuastation: for being for the most part warlike men trained vp in martiall discipline, they little or nothing at all regard the vse of husbandry: whence in short time a Countrey must needs turne wild and ynfruitfull. To these causes we may adde the influence of heavenly constellations, which being varied according to the times, produce no small effects in the changes and alterations of the earth. The diuerse alteration in the disposition of the Inhabitants which was our second point, we haue referred to another place neere the end of this tract, to which is properly appertaines.

3 *Places hauing long continued without habitati-
on, are seldom so healthy and fit for dwelling as
those which haue bene inhabited.*

This Proposition I haue knowne to bee warranted by the Testimonie of many experienced Nauigators: in so much as I presume few men can doubt of the truth of it, who hath either bene a Traueller himselve into farre Countreies, or at least hath read other mens discoueries. The onely matter therefore wee here intend, is to produce certaine causes of this effect, to giue satisfaction to such as make a distinction betwixt the knowledge of the effect, and inquiry of the cause. The first cause which I can allege is the industrie of mankind inhabiting any Countrey (mentioned in the former Theoreme) out of which ariseth a twofold effect. 1. The improuing of the Soyle, by removing all such impediments as otherwise would proue noy-
some to mankind, for whereas all things growing of their

owne accord, are suffered to rot into the ground; in like manner what other can wee expect but Fennes, Fogges, and noisome vapours, altogether hurtfull to the welfare and life of man. 2 The profit of mans industrie is no lesse apparent in manuring the ground, and opening the vpper face of the Earth: which being composed of diuerse substances, sendeth forth many times certaine hot fumes and vapours, which in many cold Countreies mollify the vsuall rigour of the Aire, which most offends the Inhabitants. This reason is giuen by my Countreyman Captaine *Whitborne* for the extreame cold, which some men professe themselves to haue tried in *New-found-land*, which neuerthelesse, according to many mens description, is knowne to lye farre more South then *England*: for the natiues of the Countrey being for the most part driuen into the North part by the *Europeans*, who vsually trade there for fish, and they themselves liuing altogether on Fish from the Sea, or some wild beasts on the land, as *Beares*, *Deare*, and such like; without any manuring of the ground for herbage; The Soyle by them is in a manner left altogether vnmanured: so that neither the soyle can bee well cleansed from noisome vapours arising from the putrefaction of herbage rotting (as I said) into the ground, or left free to send out such wholesome fumes and vapours from its interior parts, which may warme the Ayre, and preserue mankind. 3 A third reason drawne from mens Industries, that those Countreies which haue inioyed Inhabitants by the continuall vse of *Fires*, haue their Aire more purged and refined from drossie and noisome vapours, which vsually arise out of a contagious soyle, daily infected by putrefaction: for scarce any nation hath beene knowne so barbarous and ignorant which hath not the inuention and vse of Fire: neither is any infection of the aire so pestilent, and opposite to humane constitution, which the breath of fire will not in some sort dispell. If any man object the distance of houses and villages wherein fire is vsed, which seeme to claime a small interest in the change of the ayre hanging ouer a whole Countrey: let him well consider the quicknesse of motion and fluidity of the Ayre, passing (as it were) in a moment from one place to the other, and hee may
soone

soone answer his owne obiection. All those reasons hitherto mentioned an inhabited Region owes to mans industrie, which wee generally touched in the precedent Theoreme. The second cause which is as a consequent of habitation, is the necessity of breathing of people living in any Region of the earth, whereby may follow two effects. 1 A certaine measure of heat impressed into the aire, as wee see in any roome in a great throng of people, by reason of their breathing together in one place. 2 The assimilation of the Aire to humane bodies, by a continuall respiration. These alterations of the aire, might perhaps to common apprehensions, seeme small and insensible. But hee that considers how great a quantity of aire is requisite for a mans respiration, and the space and extent of motion together with the multitude of Inhabitants in a populous Countrey, would hold it no strange matter, that the breathing of men should breed such an alteration of the aire: wee finde by experience, that strong built houses being left tenantlesse, will soone fall into decay, not so much for want of reparation, as the foggy vapours and moisture, caused by want of Respiration. The like whereof in some proportion may we imagine to be in a region wanting Inhabitants, and deprived of this benefit of nature.

C H A P. II.

Of the Generall Adiuncts of Places.

1



IN a place Topographically taken two things are to bee considered. 1. The *Adiuncts*. 2. The *Description*: The *Adiuncts* are such proprieties as agree to speciall places.

2 Such

- 2 Such Adiuncts agree to a place, either in respect of the *Earth* it selfe, or in respect of the *Heauens*: Those which agree to a place in respect of the *Earth*, are either *Internall* or *Externall*.
- 3 The *Internall* I call such as are inbred in the *Earth* it selfe: which are of two sorts; either *Common*, or *Magneticall*.
- 4 The *Common* are in number three. 1 The *Magnitude*, or extent of a Countrey. 2 The *Bounds*. 3 The *Quality*. The *Magnitude* comprehends the *Length* and *Breadth* of any *Region*.

Some man might imagine that I make a needlesse repetition of these proprieties: for as much as many of them seeme to haue beene spoken of before in our *Sphericall* part. But I answer that I there handled no other matters, but such as concerned the whole globous body of the *Earth*; but my intent here is to treat of such proprieties, as particularly designe out a speciall place. For it is not one thing to speake of the *Magnitude* of the whole *Earth*, according to all its dimensions; and to treat of the manner of measuring some particular *Region*, marked out in the *Sphere*. Wee haue defined the *Magnitude* of a *Region* to bee either of *Length* or *Breadth*: because (as wee haue taught in our former chapter) it is a space contained in the surface of the *Earth*. Then can it not according to Geometricall grounds, exceed two Dimensions: These two Dimensions (as wee haue said) are length and breadth, whereof euery plaine figure, or superficies consists.

- 5 The *Magnitude* of a *Region* may bee measured

fured two wayes : either by the *Diameter*, or the *Circumference*. The *Diameter* is considered either in Latitude or Longitude : of the Latitude, whence ariseth the Breadth of a Countrey from North or South, note these Rules.

1 If the place whose breadth is sought, bee distant from the Equatour, and bee wholly situate in the same Hemisphære, the lesser Latitude subtracted from the greater will giue the *Diameter*.

To put this Rule in practise, it behooues the Topographer, who would finde out the greameste of any Region, to obserue two Latitudes : to wit, to measure the Latitude in the most Northerne point, where it is greatest : as also in the Southerne point, where it is least of all. This latter subducted from the former, will giue the *Diameter* or breadth from North to South: which may easily, according to the Rules in the former booke, bee reduced into Miles, or other such measures. For an example wee need goe no farther then our Iland of *Great Brittain*: The Southmost part of which lying about *Star-point* in *Deuon*, hath in Latitude about 50 degrees : The Northermost point situate neere the mouth of the riuer *Ardur* in the farthermost part of *Scotland*, hath in Latitude about 60 degrees (to omit minutes) The lesser of these Latitudes subtracted from the greater, the residue will bee 10 degrees, which being imagined in the Meridian which is a greater circle, are to be multiplied by 60, and so conuerted into miles, which will be 600, the length of *Britany* from South to North.

2 If the place whose Magnitude wee enquire, bee vnder the Equatour, the Southerne Latitude added

added to the Northerne will shew the breadth from the North to the South.

To illustrate this by an example, wee will take the whole continent of *Africa*, whose Southerne Latitude about the Cape of *Good hope*, wee shall finde to bee neere thirty Degrees, the most Northerne Latitude about the straights of *Gibraltar*, very neere the same rate: These two summes added together will amount to 60 Degrees, which multiplied by 60, the number of miles answerable to a degree in a great circle (because wee suppose it here to bee an Arch of the Meridian) we shall haue 3600 miles, the breadth of *Africa* from South to North.

4 The measure of the length of a Region betwixt East and West, admits of two cases: for either the Countrey is supposed to be without the first Meridian, or vnder it: both which shall be taught in these Rules.

1 If the Region be situate without the first Meridian, the lesser Longitude subtracted from the greater, will shew the Diameter betwixt East and West.

For an example of which wee will take *Cape de Barca*, lying ouer against *S. Thomas* Island in *Africa*, vnder the Equatour, whose Longitude is about 30 Degrees, and *Melinde* situate neere the Equatour ouer against *Sinus Barbaricus*, on the other side of *Africa*, which hath in Longitude 63 Degrees. The least Longitude, to wit 30, being subtracted from 63, there will remaine 33 Degrees; which being taken in a greater circle, which is the Equatour, or a Parallell very neere (which admits no sensible difference) we multiply by 60, and there will arise 1980 *Italian*-miles, but if the Degrees be taken in one of the lesser Parallels, we must proceed according to the Table of miles answerable to Degrees of Latitude in the former booke.

Another

7 Another Case is when the place is situate vnder the first Meridian: The length and measure of such a Region is found out by this Rule.

1 Let the *Westerne Longitude* bee subtracted out of the whole circle, and to the Residue added the *Easterne Longitude*, the summe will giue the greatnesse and distance betwixt East and West.

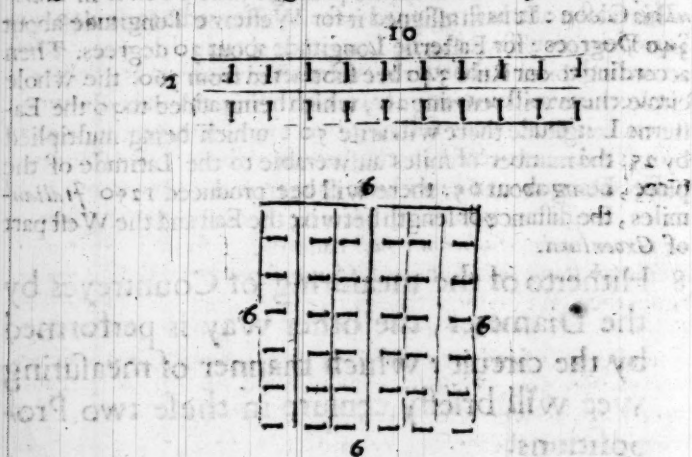
For an instance wee will take *Groenland*, supposed in most of our Globes and Mappes; to bee an Island which is set downe directly vnder the first Meridian, passing by the *Azores* in *Keris* his Globe: It hath assigned it for *Westerne Longitude* about 340 Degrees: for *Easterne Longitude* about 30 degrees. Then according to our Rule 340 bee subtracted from 360, the whole circle there will remaine 20; which being added to 30 the *Easterne Longitude* there will arise 50: which being multiplied by 25, the number of miles answerable to the Latitude of the place, being about 65, there will bee produced 1250 *Italian* miles, the distance or length betwixt the East and the West part of *Groenland*.

8 Hitherto of the measuring of Countreyes by the Diameter, the other way is performed by the circuit: which manner of measuring wee will briefly censure in these two Propositions.

1 The measuring of any Countrey by the Circuit of it, is very deceitfull and full of errors.

It hath beene a common custome amongst Navigatours to iudge of the greatnesse of any Countrey, by sayling round

about it: which kind of measuring is not alwayes to be reiected: for as much as in new discoveries sometimes no other way can bee had. Neuertheless this manner of measuring must needs prove very vncertaine for diuers reasons. First in regard of the motion of the ship, which by reason of diuerse and contrary winds, which must needs happen very frequently, cannot alwayes moue with the same swiftnesse. Secondly because the Sea it selfe (as wee shall hereafter shew) hath in diuerse places diuerse speciall motions and currents, as from the East to West; whence it must needs inforce an inequality of motion in the ship. The third reason, which is greater then all the rest, is drawne from the various *Figuration* of Countreyes, whose greatnesse cannot bee knowne by the circumference. Because (as *Geometricians* teach vs) two figures may haue one and the selfe same circuit about them, and yet the one shall extraordinarily exceed the other in greatnesse: as for example, let there be



imagined two *Parallalogrammes*; the one an exact square of six foot; the other a long square of 10 foot in Length, and two in Breadth. The one comprehends 36 square feet, the other 20,

as will appeare by multiplication of their sides, the one into the other: in which numbers there is a great inequality. Yet notwithstanding if we measure the circuit or circumference of each Figure, we shall finde them equall, to wit, of 24 foot, as will appeare by their figures here prefixed. For amongst those Figures called *Isoperimetrall*, or of equall Perimeter, that is alwayes to bee esteemed the greatest, which is the more *Ordinate* figure: which is that, which cometh neereit to an equality of *Sides* and *Angles*. But in *Inordinate* Figures (of which nature for the most part are all Regions) infinite error may be committed, if we measure them by circumnauigation: wherefore to measure a Countrey more exactly it behooueth vs not only to know the *Circumference*, but also the *Diameter*.

2 Those Countreys are more exactly measured
which partake of a plaine surface.

The reason of this Proposition is easily shewed, because a *plaine Superficie* consists of right lines. But a right line (as *Euclide* witnesseth) is the shortest betwixt his owne bounds: whereas between two points infinite crooked lines may bee drawne: whence it must needs follow, that more certainty and exactnesse is to bee expected in the measure of a *Plaine* Countrey whose *Diameter* is a *Right* line, then from a *Crooked* and hilly tray, Region, where the Corde is crooked and gibbous. Whence some *Mathematicians* haue demonstrated, that more men may stand on a *Sphericall Superficie*, as a Hill or mountaine, then on a *Plaine*, although both are found to be of the same *Diameter*. It may bee here objected, that the earth is euery where crooked and orbicular, and therefore no part thereof can bee measured by a *Right* line: I answer that the Earth is indeed *Sphericall* (as wee haue formerly proued) yet may some little part or portion thereof bee counted as a *Plaine*; because such parts haue little or no proportion to the whole masse of the Earth. This conuexity therefore being so little, may passe for a plaine without any sensible error. Hence wee may gather that the Land cannot so exactly bee measured as the Sea. For as much as the land for the most part is vneuen, varied with hills,

Dales, and other inequalities. But the Sea euery where plaine and like it selfe, except the rising of the waues and surges, which in so great a distance will make no difference at all. Secondly, we may hence collect that of two Countreies of the same bounds and figure, that must bee the greatest whose soyle and superficies is most varved and crooked: because (as wee haue said) crooked lines betwixt the same points are longer then right, and therefore measure the greater Magnitude.

9 Thus much of the Magnitude. The Bound of a Countrey is a line compassing it round.

This definition is very euident, in that euery Region is *Topographically* considered as a *Plaine* or *Superficies*, whose bound is a line compassing it round: for as a *Line* is bounded by a *Point*, so a *Superficies* by a *Line*, as wee are taught in *Geometry*. Now wee must consider that the bounds of Countreies may bee taken two manner of wayes: First *Geometrically*, for the meere line, which is imagined to goe round about it: Seconly, *Geographically*, for the visible markes and Characters, whereby the line is traced out vnto vs, such as are *Riuers*, *Cities*, *Hills*, *Castles*, and such like. These markes whereby a *Topographer* noteth out vnto vs the bounds and limits of Countreies, are of two sorts; either *Naturall* or *Artificiall*. The naturall are such as are deriued from nature without mans appointment, such as are *Riuers*, *Creekes*, *Mountaines*, *Woods*, and such like other matters, which bound the extents of Countreies. The Artificiall bounds are such as depend vpon some constitution or decree of a man, which so diuide one Countrey from another: the partition being often made where no notable marke or bound is set by nature.

I *Naturall bounds are more certaine then Artificiall.*

The reason is because naturall signes or markes which are set for bounds of Countreies are alwayes the same, and (as it were) continued from the first creation: and cannot bee changed without some great *Earthquake*, *Inundation*, or such like alteration

in nature, which very seldome happeneth, and in very few places: whereas on the contrary part, such bounds and limits, as depend vpon mans appointment, may bee altered and changed according to the wills and dispositions of men: as wee daily see amongst vs, that ancient lands and inheritances are much questioned concerning their bounds and limits: as also great controuersie is made amongst Geographers concerning the bounding of Countreyes and Territories, anciently knowne and defined by old writers: For names and particular contracts betwixt men in a few ages, may easily slip out of memory; especially when the possessours themselues (as it often happens) strue to extinguish and raze out the memory of former ages, leauing behind them no marke or signe to tell the world their wronged neighbours right, or the limited fortunes of their owne possessions.

2 *Equall bounds doe not alwayes containe equall Regions.*

This Proposition is plainly demonstrated before in this very Chapter: wherein wee haue proued of two figures supposed equall in the circumference, that to bee the greatest, which more neerely approacheth an *Ordinate* figure: which wee define to bee that which commeth neerest to an equality of Sides and Angles. So that two Regions, the one round, the other square, may haue an equall compasse about, and yet the former will bee a great deale greater, in respect of the space therein contained.

10 In the next place we are to consider the Quality. By the quality I vnderstand the naturall temper and disposition of a certaine place.

1 *Speciall places are endowed with speciall tempers and dispositions.*

That Almighty God, who created the whole world, hath not,
Bb 3 granted

granted the same gifts and indowments to all Countreyes, but hath diuided diuerse commodities to diuerse Regions, seemeth a matter out of all controuersie. For who findes not by experience one Countrey *hot*, another *cold*, a third *temperate*: one *fruitfull*, another *barren*, a third *indifferent*: one *healthie*, another *unwholsome*. The like diuersity is also found in the inhabitants themselves, according to that common prouerbe: *Valentes Thebani, Acutiores Attici*: whence this diuersity should arise, it is a hard matter to vnfold; for as much as many causes herein concur, sometimes to helpe, sometimes to crosse one the other: yet will I strue as neere as I can to reduce them to certaine Heads, by which a generall guesse may bee given to the particulars. The first reason may bee drawne from the situation of the Earth, in respect of the heauen and Starres therein fixed. This may cause a diuersity of disposition two wayes; 1 By reason of the Sun, and his generall light and influx: whence in the Earth are ingendred the foure first qualities of Heate, Cold, Drouth, and Moisture, whereon depends a great part of the disposition, not only of the soyle, but also of mans body: for as much as the one ordinarily borrowes his fruitfulness or barrenness of these first qualities: and the other hath his vitall Organes (which are the ministers of the Soule) much affected with them; in so much as some Philosophers haue vndertaken to define all the differences of mens wits and intellectuall faculties out of the Temperament of the braine, according to these foure accidents. And what Physitian will not acknowledge, all these Qualities and their mixture to challenge an extraordinary preheminance in the disposition and constitution of mans body, whose mixture is the first ground of health or sickness. The second meanes whereby the Heauens may cause a diuersity of temper in diuerse places, is from the *speciall Influences* of some particular Starres and constellations incident to particular places: for it were blockish to imagine that so many various Starres of diuerse colours and magnitudes should bee set in the Firmament to no other vse then to giue light to the world, and distinguish the times: sith the ordinary Physitian can easily discouer the Moones influence by the increase of humours

mours in mans body : and the experience of Astrologers will warrant much more by their obseruation : as assigning to each particular aspect of the Heauens a particular and special influence and operation. Now it is euident that all aspects of the Heauens cannot point out and designe all places alike ; for as much as the beames wherein it is conueyed , are soine where perpendicularly , other where obliquely darted , and that more or lesse according to the place : whence it commeth to passe that neither all places can enioy the same Temperament , nor the same measure and proportion. Yet wee say not that the heauenly bodyes haue any power to impose a *Necessitie* vpon the *wills* and dispositions of men ; but onely an inclination : For the Startes worke not Immediatly on the intellectuall part or minde of man , but Mediatly , so farre forth as it depends on the Temperament and materiall organes of the body. But of this wee shall especially speake hereafter. Where (God willing) shall bee opened the manner of this celestiaall operation. By this wee may vnderstand how farre the Heauens haue power to cause a diuersity in Places and Nations. The second reason may bee the *Imbred Quality* , *Figure* , and *Site* of the Places themselves ; For that there is another cause of diuersity besides the situation of places in respect of the Heauens , may easily be proued out of experience ; for wee finde that places situate vnder the same Latitude , partake , of a diuerse and opposite Temper and disposition , as the middle of *Spayne* about *Toledo* , which is very hot and the Southermost bound of *Virginia* , which is found to bee Temperate betwixt both : All which notwithstanding are vnder the selfe-same Latitude , or very neere , without any sensible degree of difference : also we sometimes finde places more Southward toward the Equatour to partake more of cold , then such as are more Notherne , as the Toppes of the *Alps* being perpetually couered with Snow , are without question colder then *England* , although they lye neerer to the equinoctiall. Likewise *Aluarez* reporteth that hee saw Ice vpon the water in the *Abyssines* Countrey in the month of Iuly , which notwithstanding is neere or vnder the Line. And *Martin Frobi-ber* relates , that he found the ayre about *Friezland* more cold &

stormy about 61 degrees then in other places neere 70 degrees. Wherefore we must needs ascribe some effect and operation to the soyle it selfe: first in respect of the *Superficies* which is diuersly varied with *Woods*, *Riuers*, *Marishes*, *Rockes*, *Mountaines*, *Valleyes*, *Plaines*: whence a double variety ariseth: first of the foure first *Qualities*, which is caused by the *Sunne-beames* being diuersly projected according to the conformity of the place: Secondly, of *Meteors* and *Exhalations* drawne vp from the Earth into the Aire: both which concurring must needs cause a great variety in mans disposition: according to that prouerbe, *Athenis tenue calum*, *Thebis crassum*: or that bitter taunt of the Poet on *Bæotians*, *Bæotum in crasso inuaret aëre natum*. For ordinary experience will often shew that a thinne and sharp ayre vsually produceth the best witts; as contrariwise grosse and thicke vapours drawne from muddie and marish grounds thicken and stupifie the spirits, and produce men commonly of blockish and hoggish dispositions and natures, vnapt for learning, and vnfit for ciuill conuerlation. Secondly, there must needs be granted to speciall Countreyes, certaine *Specificall* qualities, which produce a certaine *Sympathie*, or *Antipathie* in respect of some things or others: whence it commeth to passe that some plants and hearbs, which of their owne accord spring out of the Earth in some Countreyes, are found to pine & wither in others: some Beasts and Serpents are in some places seldome knowne to breed or liue, wherewith notwithstanding other Regions swarme in abundance: as for example, *Ireland*, wherein no Serpent or venomous worme hath beene knowne to liue, whereby *Africa* and many other Countreyes finde no small molestation. Neither is this variety onely shewne in the diuersity of the kindes, but also in the variation of things in the same kinde, whereof we might produce infinite examples. For who knowes not, which is a Physition, that many simples apt for medicine growing in our land, come farre short in vertue of those which are gathered in other countreyes. I need amongst many ordinary instances giue no other then in our *Rubarb* and *Tobacco*: whereof the former growing in our Countrey, except in case of extremity, is of no vse with our *Physicians*: the other

as much scorned of our ordinary Tobacconists : yet both generally deriued from the true mother the *Indies*, in great vse and request. But of this last Instances are most common, and yet for their ignorance of the true cause, most admirable. The causes of the former might in some sort bee found out either in the Heauens, or in the Elementary nature of the Earth. But some speciall proprieties haue discovered themselves, which cannot be imagined to owe their cause to either, but to some third originall, which the Physicians in their Simples more properly tearme *virtus specifica*. If any man should demand why countreyes farther from the course of the Sunne should be found *hotter*, then some which are neerer ? Why the *Rhenish* wine Grape transported from *Germany* into *Spaine*, should yeeld vs the *Sherry Sacke* ? Euery ordinary Phylosopher, which hath traueled little beyond *Aristotles Materia Prima*, will bee ready to hammer out a cause, as ascribing the former to the Heigh or Depression of the soyle: the latter to the excesse of heat in *Spaine* about that of *Germany*. But should wee farther demand, 1 why *Ireland* with some other Regions indure no venemous thing. 2 Why Wheat in *S. Thomas* Island, should shut vp all into the Blade, and neuer beare graine ? 3 Why in the same Island no fruit which hath any stone in it, will euer prosper ? 4 Why our Maltiffes (a seruiceable kinde of creature against the molestation of Wolues, and such hurtfull beasts) transported into *France*, should after a litter or two degenerate into Curres, and proue altogether vnseruiceable ? 5 Why with vs in *England*, some places produce Sheep of great stature but course wooll ; other places small Sheep, but of very fine wooll : which being naturally transplanted, will in a generation or two so degenerate the one into the others nature, that the greater sheep loose somewhat of their greatnesse, yet improue their fleeces ; as the other increase their stature, but loose much in the finenesse of their wooll ? 6 Why many places at the ridge of the mountaines *Andi* in *America* cannot bee passed ouer without extreame vomitting and griping euen vnto death. 7 Why a Riuer in the *Indies* should haue such a nature to breed a great long worme in a mans leg, which oftentimes proues mortall

vnto.

vnto the patient, with infinite the like examples found in Geographers, concerning the nature and accidents of *Fountaines*, *Hearbs*, *Trees*, *Beasts*, and *Men* themselues (as wee shall shew hereafter) so much varied according to the disposition of the soyle, what wiser answer can an ingenious man expect then silence or admiration? for to make recourse to *Sympathies*, *Antipathies*, and such hidden qualities with the current of our Philosophers, is no other then in such sort to confesse our owne ignorance, as if notwithstanding, wee desired to bee accounted learned: for beside the difference of the termes wherein euery Mountebanke may talke downe a iudicious Scholler; I see no aduantage betwixt a Clowne which sayes he is ignorant of the cause of such an effect, or of a iuggling Scholler which assignes the cause to bee a *sympathie*, *antipathie*, or some occult quality. I speake not this to countenance supine blockishnesse, or to cast a blocke in the way of curious industrie. The former disposition I haue alwayes hated, and the latter still wished in my selfe, and admitted in others. All which I can in this matter propose to a curious wit to bee sought, must bee reduced to one of these two heads: for either such admirable effects as we haue mentioned, must arise from some *Formall* and *Specificall* vertue in the soyle, or from some extraordinary Temperament made of a rare combination of the Elements, and their secondary mixtures, as of *Hearbs*, *Stones*, *Mineralls*, and vapours arising from such, and affecting the Aire: of both which wee shall haue some occasion to treat in the particular Adiuncts of places; yet so, as I feare I shall neither giue my selfe content, or my Reader any sufficient satisfaction. But *In magnis voluisse sat est.*

- II Hitherto of the common imbred Adiuncts of the Earth Topographically taken: Next we will speake somewhat of the *Magneticall Affections* of a place: These are in number two, viz: *Variation* and *Declination*.

We haue in our former Treatise of the *Magneticall* nature of the Earth handled diuerse other affections, growing from the Magneticall Temper and disposition of the terrestriall Globe: whence some man might here collect this repetition to bee altogether needlesse, or at the least imperfect, omitting many other of the Magneticall Affections. To this I answer, that it is one thing to speake of these Affections as they agree to the whole Spheare of the Earth: Another thing to consider them, as they are particular proprieties, and markes of particular places and Regions. In the former sort haue we) besides the Variation and Declination) handled many other affections of the Earth magnetically considered. Wee here onely speake of these two, as they are speciall markes and proprieties of speciall places: which it behooues a *Topographer* to obserue as a matter worthy of obseruation in the description of any place. The vse shall be commended vnto vs in these two Theoremes.

1. *The Magneticall Variation is of no vse for the first finding out of the Longitude; yet may it serue to good purpose for the Recognition of a place heretofore discovered.*

The reason of this wee haue shewne in our former booke; because the variation seldome or neuer answeres proportionally to the Longitude; as some of the ancients on false grounds haue surmised: whence no true consequence can bee drawne from the variation of a place to the finding out of the Longitude; yet may it bee of speciall vse for the new finding out of such places as haue formerly by others beene first discovered, so the variation were first by them diligently and faithfully noted and obserued: first because few places in the Earth can exactly and precisely agree in the selfe-same variation; but in some Degree or minute will bee found to varie. Secondly, if any two places should bee found to accord in the same Degree of Variation; yet comparing the variation with the degree of Declination, wee shall commonly finde a difference: for as much as places agreeing in variation, may notwithstanding varie in the Declination.

Thirdly

Thirdly, if two places should be equalized in both (as wee cannot deny it to bee possible) yet the comparing of these two Magneticall motions with other affections, as well in respect of the Earth it selfe as of the Heauens, will giue at least a probable distinction: of which cases it is not hard out of the obseruations of our new writers and Nauigatours to giue particular instances. Concerning the *first*, we finde the variation of the compasse at *Cape Verde*, to bee iust 7 Degrees; about the Ilands neere to *Cape Verde* to amount only to 4 Degrees; whence a Sea-man (if other helps failed) may hereafter, as he passeth, distinguish the one from the other, and if occasion serue, correct this error. In the like sort might a man (otherwise altogether ignorant of the place) out of former obseruations, in the same Iland of *Cuba* distinguish betwixt *Cape Corientes* and *Cape S. Anthony*; In that the one hath only 3 degrees of variatio, whereas the other hath 13: for an instance of the *second case* we will take the coasts of *Brasil* 100 leagues distant from the shoare, & *Cape Corientes* beyond *Cape bona spei*, which agree in the same variation: to wit, amounting to 7 Degrees 30 minutes: which notwithstanding are distinguished by their seuerall declination: for howsoeuer the magneticall motion of variation being of late inuented, hath not so particularly beene traced out in all or most places, yet must the declination of each place needs be different; for as much as the former hath 23 degrees of South Latitude, the other none at all lying iust vnder the Equinoctiall: since the Latitude (as wee haue formerly taught) is in some measure proportionall to the Declination. For the third, if any two places bee found agreeing both in *Variation* and *Declination*, as may bee probably guessed of *Cape Rosse* in *S. Johns* Iland, and the west end of *S. John de Porto Rico*: the Latitude being all one as of 17 degrees 44 minutes: and the variation admitting perhaps insensible difference, to wit, of a little more then one degree: yet might this helpe conioyned with former Trauellers report, or some small obseruation of heauenly bodies, or sounding the bottome of the Sea, settle our opinion and make a plaine distinction.

- 2 *The Declination of any place being knowne the Latitude may also bee found out, although not without some error.*

The ground of this Assertion we haue formerly handled in the Treatise of the Magneticall Affections of the Earth: where wee haue shewed that the Declination of the Magneticall needle is alwayes answerable in some proportion to the Latitude of the place: whence it must needs follow, that the declination any where being found out together with the proportion, the Latitude must needs be knowne. In this point I referre my Reader to D. *Ridley's* late Treatise of Magneticall bodies and Motions, wherein hee by the helpe of M. *Briges*, hath calculated a certaine brieve table for this purpose. But that this manner of Inuention of the Latitude of a place, must needs admit of some error, cannot well be denied; for as much as *Gilbert*, *Ridley*, and others, which haue written of this subiect; haue acknowledged this motion of Declination to bee in many places irregular, and not answerable in due proportion to the Degrees of Latitude, which diuerse friends of mine, well experienced in magneticall experiments, haue to their great wonder confessed.

- 12 This much for the *Internall* Adiuncts The *Externall*, I call such as are not imprest into the Earth, but externally adjacent or adioyning vnto it. Here ought wee to consider the *Aire* adioyning to any place with his Qualities and Proprieties.

- 13 The Ayrie properties of a place consist in such matters, wherewith the Ayre according to diuerse places is diuersly affected and disposed.

In the Ayre we ought to note a twofold temper and quality,
the

the one *Inbred* and *Essentiall*: the other *Externall* and *Accidental*, The former, whether it bee heat ioyned with moisture, as *Aristotle* affirms, or cold ioyned with moisture, as some others, I leaue it to the Naturall Philosopher to dispute. The latter being that to which our purpose is chiefly ingaged, and that no farther then may appertaine to the Topicall description of a speciall Countrey. These accidents being so various and many, we are enforced to reduce them to a few generall heads which we will couch in this our Theoreme.

1 *The disposition of the Ayre adjacent to a place depends chiefly on the Temperament of the Soyle.*

Those things wherewith the Aëriall Region is affected, are of two sorts; to wit, either the *Temperament* consisting in the mixture of the foure first *Qualities*; or else the bodies themselves, as *Meteors* drawne vp into the Aire, wherof these accidentall dispositions arise. That both these chiefly depend from the *Temperament* of the Earthly Soyle of a certaine place, many reasons will demonstrate: first that *Meteors*, whatsoeuer they are, take their originall from the Earth, is plaine. 1 Out of the name, which signifies things lifted vp, to shew that a Meteor is lifted and drawne out of the Earth. 2 Out of the materiall composition, which can no where else take this composition: For either wee should deriue it from the *Heauens*, or from the *Ayre* it selfe, or from the *Fire*: From the *Heauens* it cannot take originall; because it is corruptible, and therefore of no heavenly substance according to *Peripatetike* Philosophie. Not from it selfe, because the aire being supposed a simple and uncompounded body, cannot admit of such mixture. Not from the *Fire*; first because all *Meteors* partake not of fierie nature. Secondly, because fire cannot well subsist, but of some matter whereon it may worke, and conserue it selfe, which can bee no other then that which is of a glutinous substance: which wee no where finde but in the earthly Globe, consisting of Earth and Water; out of whose store-houses, the matter of all such pendulous

dulous substances in the aire is deriued. These Meteors may bee deriued from the Earth into the Aire, two manner of wayes. First, *Directly* and immediatly, by an immediate ascent or rising of exhalations from some one particular place into the Ayrie space right ouer it. Secondly, *Obliquely*, to wit, when Vapours, or other such exhalations are by some violence or other carried from one place into another: as winde, which being ingendred in one place, continually bloweth into another. Again, the former may happen two wayes: for either this rising of Exhalations out of the Earth, is *Ordinary*, or *Extraordinary*: Ordinary I call that whereby the thinne parts of the water or Earth are continually spread and diffused through the whole Region of the Ayre: for wee cannot imagine otherwise then that at all times and places, the Terrestriall Globe composed of Earth and Water, continually sends and euaporates out some thinne or rarified parts, wherewith the earth is affected. Whether this Rarefaction or Euaporation of the water bee the true substance of the Aire it selfe (as some haue probably coniectured) or else some other body different from it, I will not here dispute. This much will necessarily follow, that it proceeds originally from the Earth right vnder it. This vapour being ingendred from the water or moister parts of the Earth, is much varied and temper'd according to the place from which it ariseth: For the matter of the Earth being various and diuerse in disposition, as well in regard of various veines of minerall substances, whereof it consists, as of the first and second qualities thereof arising, must of necessity cause the Aire about each Region to bee of the same quality. Whence a probable reason may bee shewne; why of two places, although both like in respect of the Heauens, and other circumstances, one should bee hot, the other cold; one healthie, another contagious; the one of a sharpe and thinne aire, the other of a foggy & dull temper: For no question but the minerall matter whereof the soile of the Earth consists, being not euery where Solid and hard, but euery where intermedled with a vaporous and fluide substance, must needs challenge a great interest in the temperament of the Ayre, as that which is the first mother, if not of


the

the Aire it selfe, yet at least of the accidentall dispositions thereof. The *Extraordinary* euaporations, I call such as arise out of the Earth by some extraordinary concourse of the Sunne, with some other Starres. These are many times subiect to sense, which happen not at all times and places: such as are clowdes, windes, and such like, which arise not naturally by their owne accord by a perpetuall emanation, but are by some greater strength of the Sunne or Starres ratifying the parts of the earth or water drawne vp to the Aire about it. Now for the Meteors *Indirectly* and obliquely belonging to any place, amongst many other instances, we may bring the winde which bloweth from one Region to another; which according to ordinary experience partaketh of a twofold quality; the one deriued from the place whence it is ingendred; the other from the Region through which it passeth. Which may appeare by our foure Cardinall windes, as they are with vs in *England*, *Belgia*, and higher *Germany*. For first our Easterne winde is found to bee driest of all others, whereof no other cause can bee giuen; then that it comes ouer a great Continent of land lying towards the East, out of which many drie and earthly exhalations are drawn: so the Westerne winde is obserued to be very moist, because it passeth ouer the hugie *Atlantick* Ocean, which must needs cast forth many watrie and moist vapours, which beget raine and showres: from the moisture of which Westerne winde some haue sought out an answer to that Probleme: why hunting hounds should not sent, nor hunt so well, the winde being in the West, as at other times? For, say they, it is caused by the moisture of it, either in making hinderance to their legges in running, or at least to their smell, being very thicke and foggy. In this Westerne winde we may also perceiue much cold, which is caused by the quality of those watrie vapours, through which it passeth, which being drawne from the water, are naturally cold. In our South wind wee shall finde both heat and moisture: whereof the former ariseth from the Sunne, which in those Southerne Regions neere the Equatour is most predominant; The latter from the naturall disposition of the places because before it approacheth our coasts, it passeth ouer the
Mediterr-

Mediterranean Sea, out of which the Sunne begets abundance of watry vapours, which mixt themselues with the windes. Finally the *North-winde* is obserued to bee cold and drye. It must of necessity bee cold: because it is carried ouer diuerse cold and snowy places, most remote from the heat of the Sunne. It is drie, because it passeth ouer many Ilands and dry places, sending out store of dry exhalations: as also because the Sunne being very remote, from those Regions, fewer exhalations are drawne vp, which might infect it by impressions of their watric quality. These instances may serue to proue our assertion: That Meteors, wherewith the Aire is vsually charged, and by consequence, their qualities imprest into the Aire, are depending from the Earth, out of which they are drawne, either *Directly* from the same Region which they affect; or *Obliquely*, from some other Region remote from it. Howsoeuer, wee obserue, that the disposition of the Ayre depends from the Soile, wee cannot altogether exclude the Heauens, as shall bee taught hereafter in place conuenient.

C H A P. III.

*Of the the Adiuncts of a place in respect
of Heauens.*

- 1  E haue in the former Chapter spoken of the Adiuncts of a place in respect of it *Selfe*. We are now to proceed to such Accidents as agree to a place, in respect of the *Heauens*.
- 2 The Adiuncts of the Earth in respect of the Heauens are of two sorts; either *Generall* or *Speciall*.

C c

Gene

Generall, I call such as are abstracted from any speciall quality, or condition of the Earth, or any place in the Earth. These accidents concerne either the *Situation* of the Inhabitants, or the *Division* of the places: both which we haue handled in our *Sphericall* part of *Geographie*: The *Speciall* are such as concerne the nature of the place in respect of the Heauens, not *Absolutely*, but *Respecting* some speciall qualities or properties depending on such situation; which more properly belongs to this part: For the vnfoling of which, before we descend to particularities, we will preface this one generall Theoreme.

1 *Places according to their diuerse situation in regard of the Heauens, are diuersly affected in quality and constitution.*

This Proposition needs no prooffe, as being grounded on ordinary experience: for who findes not betwixt the North and the South, a manifest difference of heat and cold, moisture and drouth, with other qualities thereon depending, as well in the temper of the soyle it selfe, as the naturall disposition of the inhabitants. Only three points will here require an exposition: First, by what *Meanes* and instruments the Heauens may bee said to worke on the Earth. Secondly, how farre this operation of the Heauen, on the Earth may extend, and what limits it may suffer. Thirdly, how these operations are distinguished one from the other. Concerning the first, wee are taught by our ordinary Philosophers, that the Heauens worke on inferiour bodies by three instruments, to wit, *Light*, *Motion*, and *Influence*. By *Light*, as by an instrumentall agent, it indendreth heat in the Aire and Earth; not that the light being in a sort an Immateriall quality, can immediatly of it selfe produce heat, being materiall and elementary; But by attrition and rarefaction, whereby the parts of the aire being made thinner, approach neerer to the nature of fire, and so conceaue heat. This is againe performed two wayes; either by a simple or compounded beame. The simple Ray is weaker: The compounded inferring a doubling of the Ray by *Reflection*, is stronger and of more

more validity in the operation : and by consequence so much the more copious in the production of heat ; by how much more the reflection is greater : if wee meereley consider it in regard of the Heauens , without any consideration of the quality of the Earth. By motion the heauens may exercise their operation on the Earth two wayes. First , by attenuating and rarefying the vpper part of the Aire next adioyning ; turning it into *Fire*, (as some Philosophers would haue it) whence the inferior parts of the ayre communicating in this affection must needs partake some degrees of heat ; But this I hold to bee a conceit grounded onely vpon *Aristotles* authority ; who supposed the heauens to bee a solide compact body : which will not so soone bee granted of many more moderne Mathematicians. Secondly, the heauenly bodyes may bee said to worke on inferior things by motion ; in that by motion they are diuersly disposed and ordered to diuerse Aspects and configurations of the Starres and Planets , whereby they may produce diuerse effects : so that in this sense the heauens are imagined as a disponent cause , which doth not so much produce the effects themselves as vary the operation. Hereon is grounded all Astrologie , as that which out of diuerse aspects and combinations of the Planets and Signes foresheweth diuerse euents. The third Instrument , by which the Heauens are said to worke , is the heauenly influence ; which is a hidden and secret quality not subiect to sense , but only knowne and found out by the effects. This third agent being by some questioned , would hardly bee beleueed ; but that a necessity in nature constraines it. For many effects are found in inferior bodies , caused by the heauens , which can no way be ascribed to the *Light* or *Motion*. As for example , the production of *Mettals* in the bowels of the earth , the *Ebbing* and *Flawing* of the Sea ; whereof neither the one or the other can challenge any great interest in the *Light* : For as much as the former is farre remote from the Sunne-beames : the other ceaseth not to moue in his channell , when the Sunne and Moone are both vnder the Earth. Besides , who can giue a reason of the excesse of heat in the *Canicular* or Dog-dayes , if wee exclude this influence ? For if wee consider the *Light* of the

Sunne, wee shall finde it greater at the time of the *Solstice*; the reflection being greater approaching neerer to right Angles. If wee consider the Earth, wee shall finde no reason at all, why the heat should be more predominant at this time then another. Then must wee of necessity ascribe it to a speciall *Influence* of the *Dog-starre* being in coniunction with the Sunne. Many other Instances might bee here produced, but I hold it needlesse, being a matter consented to amongst most Philosophers. The second point concerne the *Extent* and limitation of this operation in inferiour bodies: for vnfoling of which point, wee must know that this operation may haue respect either to the Elements of *Earth* and *Aire*, or else to the Inhabitants residing on the Earth. For the operation of the Heauens vpon the Elementary masse, experience it selfe will warrant; yet with this limitation, that this operation is measured and squared according to the matter whereinto it is receaued: as for example, wee shall finde the *Moone* more operative and predominant in *moist* Bodies, then in others, partaking lesse of this quality. Likewise the heat caused by the Sunne more feruent where it meets with a subiect which is more capable. Whence it comes to passe that one Countrey is found hotter then another, although subiect to the same Latitude in respect of the Heauens: for howsoeuer the action of the Heauens bee alwayes the same and vniforme in respect of the Heauen it selfe, yet must the same bee measured and limited according to the subiect into which it is imprest. For the Inhabitants, wee are to distinguish in them a twofold nature: the one *Materiall* as partaking of the Elements, whereof euery mixt body is compounded. The other spirituall, as that of the Soule. The former wee cannot exempt from the operation of the Heauens: for as much as euery Physician can tell how much the humours and parts of our body are stirred by celestiall influence, especially by the *Moone*, according to whose changes our bodies dayly vndergoe an alteration. For the humane soule, how farre it is gouerned by the stars is a matter of great consequence; yet may wee in some sort cleere the doubt by this one distinction. The Heauens may bee said to haue an operation vpon the soule two manner of wayes.

First,

First, *Immediately* by it selfe, Secondly, *Mediately* by the humours and corporall organes, whereof the Soules operation depends. The first wee absolutely deny; for the soule being an immateriall substance, cannot bee wrought vpon by a materiall agent, as Philosophers affirme: for the second, it may bee granted without any absurdity: For the operation of the soule depends meereley on materiall and corporall organes. The Elementary matter, whereof these organes consist, are subiect to the operation of the Heauens, as any other Elementary matter. So that wee may affirme the Heauens in some sort to gouerne mens mindes and dispositions, so farre forth as they depend vpon the bodily instruments. But here wee must note by the way, that it is one thing to inferre a *Necessity*; another thing to giue an *Inclination*. The former we cannot absolutely auerre; for as much as mans will, which is the commandresse of his actions, is absolutely free not subiect to any naturall necessity, or externall coaction. Yet can wee not deny a certaine inclination; for as much as the soule of a man is too much indulgent vnto the body, by whose motion it is rather perswaded then commanded. The third point we haue in hand, is to shew how many wayes the Heauens by their operation can affect and dispose a place on the Earth. Here wee must note that the operation of the Heauens in the Earth is twofold; either *ordinary* or *extraordinary*. The ordinary is againe twofold; either *variable* or *Invariable*. The variable I call that which is varied according to the season, as when the Sunne by his increase or decrease of heat, produceth *Summer* or *Winter*, *Spring*, or *Autumne*: which operation depends from the motion of the Sunne in his *Eclipticke* line, wherein hee comes sometimes neerer vnto vs, sometimes goeth further from our verticall point. The Invariable, I call that, whereby the same places are supposed to inioy the same temperament of heat or cold without any sensible difference in respect of the Heauens; putting aside other causes and circumstances: for how soeuer euery Region is subiect to these foure changes, to wit, *Summer*, *Winter*, *Spring*, and *Autumne*: yet may the same place inioy the same temperament of Summer and Winter one yeere as it doth another without any great

alteration : and this depends from the situation of any place neerer or farther of in respect of the *Equinoctiall* circle. The *Extraordinary* operation of the Heauens depends from some extraordinary combination or concurse of Planets particularly affecting some speciall place ; whence the cause may bee probably shewed why some place should some yeeres prone extraordinary fruitfull, other times degenerate againe to barrenesse : or why it should sometimes bee molested with too much drouth, and other times with too much moisture. To let passe the other considerations as more appertaining to an *Astrologer* then a *Geographer*, wee will here onely fasten on the *Inuincible* operation of the Heauens on earthly places ; and search how farre forth the places of the Earth are varied in their Temper & Quality, according to their diuerse situations, and respect to the *Equinoctiall* circle ; taking onely notice of the Diurnall and ordinary motion of the Sunne in his course. Herein shall wee finde no small variety, not onely in the temper of the Ayre, but also in the disposition and complection of the Inhabitants : both which we shall more specially declare : the former in this Chapter ; the other in due place : wherein we shall haue occasion to treat of the materiall constitution and manners of diuerse Nations.

- 2 In respect of the Heauens, a place may be diuided two wayes : First, into the North and South. Secondly, into the East and West.
- 3 Any place is said to be *Northerne* which lyeth betwixt the *Equatour* and *Arcticke Pole*. *Southerne*, betwixt the *Equatour* and the *Antarcticke Pole*.

The whole Globe of the Earth (as we haue formerly taught) is diuided by the *Equatour* into two Hemispheres ; whereof the one is called *Northerne*, lying towards the *Northerne* or *Arcticke Pole* : the other towards the other Pole is called the *Southerne*.

Southerne. But here to cleere all doubt, wee must vnderstand that a place may be said to be Northerne or Southerne two manner of wayes: either *Absolutely* or *Respectively*: Absolutely Northerne and Southerne places are tearmed, when they are situated in the *Northerne* or *Southerne* Hemisphaeres, as wee haue taught in this Definition: But such as are Respectively Northerne, may be vnderstood of such Regions, whereof the one is situate neerer the Pole, the other neerer the Equatour. In the first place here wee are to consider a place as it is absolutely taken to be either North or South: Concerning which we will particularly note these two Theoremes.

I. Northerne and Southerne places alike situate, generally inioy alike disposition.

Wee haue formerly granted to euery Region or Countrey a speciall quality or temper: although lying or situate vnder the same Latitude. But here excluding all concurrent causes which may vary the temper of the Soile, wee consider the disposition of a place so farre forth as it depends on the *Heauenly Influence* or operation. In which sense we cannot deny to a place of like site, a like nature, for as Philosophers vse to speake, *Simile quæ simile semper aptum natum est simile producere*: Like causes alwayes produce like effects: so the Heavens in like distance, being disposed alike as well in regard of *Light* as *Influence*; cannot but affect those parts of the Earth in the selfe-same manner. For the Instruments by which the heavens worke on inferior bodies (as we haue shewed) are *Light* and *Influence*: For both the *Light* and *Influence*; it is certaine that in places of equal Latitude and respect to the Equatour; it is cast equally: both the one and the other being imagined to be carried in direct lines of beames, which with the *Horizon* makes like Angles. Now that the validity or weaknesse of the operative Rayes is to bee iudged according to the *Right* or *Oblique* incidency, making right or oblique Angles; no Mathematician will gaine say. But here we must note by the way, that wee only consider the Heauen according to his generall Influence or operation depending chiefly on the Sunne: not of the speciall operation

of speciall Starres, for it may be some particular constellations in the Northerne Hemisphære may bee indowed with some speciall influence, which is not found in the Southerne; or the South in this kinde goe beyond the North. But this kinde of Influence is rare and hard to finde, by reason of the various mixture of diuerse constellations in their operation in the same subject: and howsoeuer it were well knowne, yet it is not so notable to take place before this common Rule, which wee shall finde to take place, if not exactly, yet commonly throughout the whole Terrestriall Spheare. Thus *Adam* shewes a great likenesse betwixt the higher *Germany*, and the kingdome of the *Pastagones*, in the South part of *America*, out of the great *Stature* of the Inhabitants, which must needs proceed out of the nature of the places, which are found to be situate very neere vnder the same *Parallell*. The like correspondency haue wee noted betwixt *Gusnea* in *Affricke* and that part (as it is thought) of the *South Continent*, which they haue for this cause tearmed *Noua Guinea*: many more *Parallels* in this kinde might be found out; but these may suffice in so euident a matter.

2 *The Northerne Hemisphære is the Masculine, the Southerne the Feminine part of the Earth.*

It hath beene a vsuall kinde of speech amongst men to tearme such things as are stronger, worthier, or greater, *Masculine*: on the contrary side such things *Feminine*, as are found deficient and wanting in these perfections: by which kinde of Metaphor taken from the Sexes in liuing creatures they haue ascribed to the Northerne Hemisphære a Masculine Temper in respect of the Southerne, which comes farre short of it: for howsoeuer no cause can bee shewed in regard of the Heauens (as is taught in our former propositions) except by some speciall constellations of the South, which is full of vncertainty, and as soone denied as affirmed; yet comes it to passe by some hidden propertie of the places themselves, or at least some casuall Accident or other, that these two Hemisphæres suffice a great and notable

notable disparity. For against the large and fertill Territories of the Northerne Hemisphere containing in it wholly *Europe* and *Asia*, with the greatest part of *America* and *Africa*, wee shall finde (besides some few scattered Islands) only three continents to oppose, to wit, a small part of *Africa*, the greatest part of *America Peruviana*, containing in it *Peru*, *Brasil*, and the Region of the *Paragones*, and the South continent called *Terra Australis Incognita*, and by some others, the *South Indies*. For the former lying neere the *Cape of good hope*, if we will credit the relations of our owne Merchants, we shall finde the aire by reason of her very discomperated sitwat betwixt the Equator and the Tropicks of *Cancer*. The land very barren, the Inhabitants of a brutish disposition, wanting (as it were) all sence of science or religion: bearing heavy as yet the curse of *Noah*, the first Father of that *African Nation*. For *America Peruviana* wee shall finde it perhaps more happy in respect of the Soyle, although little better in respect of the Inhabitants. Yet for the plentie of Gold-mines, whereof they can chiefly vaunt, wee shall finde it farre surmounted by the *East Indies*, or at least paralleled by *America Mexicana*, lying on this side the Equinoctiall circle. For other commodities, as *Cattle*, *Fruits*, *Herbage*, *Spices*, *Gummes*, and other medicinable roots, and minerais, lesse question can be made, as being farre inferior to *Europe*, *Asia*, *Mexicana* and other Regions included within our Northerne partition. Of the third and greatest, which is the South continent, no coniecture can be well grounded, being in a manner all vndiscovered, except some small quillets on the borders of it: by which, if wee may iudge of all the rest, wee shall almost give the same iudgement, as of the other. The want of discovery in this age of ours, wherein Navigation hath become perfected and cherished, is no small argument to prove it inferior in commodities to other places. Neither had the backnesse of the *Spaniards* given that occasion of complaint to *Ferdinand de Quir*, the late discoverer of some of these parts, had not the *Spanish King* thought such an expedition either altogether fruitlesse, or to little purpose. For who knowes not the *Spaniards* to bee a Nation as covetous of riches

as ambitious to pursue for aine Soueraignty: as such who will more willingly expose the lines of their owne subiects, then loose the least title over other Countreys. This may bee a probable argument, that this Continent hath not as yet so well smited on the ambition of this proud Nation, as some other conquests. For *Politick* and *Martiall* affaires, how faire short it comes of our Northerne Hemisphere, I shall speake in due place, where I shall handle the naturall disposition of diuerse Inhabitants according to their situation. To finde out the true causes of this diuersity, is very difficult: To seeke a reason in some particular constellation, and influences in the Heauens, or some speciall disposition of the soyle, is too generall to giue satisfaction, and too vncertaine to enforce credulity. Yet putting these aside; I can only guesse at two reasons, which are accidentally, yet strengthened with good probability. The first and greatest is that bitter curse cast on *Cham* and his posterity by his father *Nabb*, which no doubt was seconded by Gods displeasure taking place in his habitation. For all these Nations sprung from *Cham*; I dare not confidently touch: Yet for the most part, it is probable they were of this Race. For the *Africans* it is out of question as warranted by the holy Scripture, and it is not unlikely that many of those Southerne people fetcht their first originall from thence. The second cause may bee drawne from the *Industrie* and labour of the inhabitants in tillage and manuring of the ground, wherein the Southerne inhabitant hath bene more deficient. For it is certaine out of the holy Scripture that *Noahs* Arke, wherein was the Seminary of mankind, and almost all other living creatures, rested in the Northerne part of the world: whence both man and beasts began to be propagated toward the South, no farther then necessity enforced: the Regions inhabited growing daily more and more populous, and (as it were) groaning to be deliuered of some of her children. Hence may be inferred two considerations. First, that the Northerne Hemisphere was inhabited longer, and is now therefore more populous then the Southerne. Secondly, that the chieftest and principall men, which were best fited rather chose to keepe their ancient habitation, tending
such

such abroad, who could either bee best spared, or had the smallest possessions at home. Yet notwithstanding it cannot be imagined but they retained with them a sufficient company and more then went away. Out of which it must needs be granted, that the *Northerne* halfe of the Earth being best inhabited, should be best manured and cultured; from whence the ground must in time proue more fruitfull and commodious for habitation: for as a fruitfull Countrey for want of the due manuring and tillage doth degenerate and waxe barren, so diuerse barren and sterill Countreies haue by the industrie of the Inhabitants beene brought to fertilitie, and made capable of many good commodities necessary for mans life. If I were curious to draw arguments from the nature of the Heauens; I could alleage the *Greatnesse* and *Multitude* of Starres of the greater magnitude in our *Northerne Hemisphere*, wherein the *Southerne* is deficient, as also the longer sojourning of the Sun in our *Northerne Hemisphere*: but these as vncertaine causes I passe over. Other reasons may perchance bee found out by those who are inquisitive into the secrets of nature, to whom I leaue the more exact search of these matters.

4 Either Hemisphere consisting of 90 Degrees may be diuided into three parts, each of them containing 30 Degrees.

5 Of these parts 30 we allot for Heat, 30 for Cold, and 30 for Temperature: whereof the former lyeth towards the Equatour, the second towards the Pole, the third betwixt both.

The ancient Cosmographers (as wee haue shewed in our former Treatise) diuided the whole Globe of the Earth into five *Zones*, which they supposed had also proportionally diuided the Temper and disposition of the Earth. In such sort that according to the Degrees of Latitude the Heat and Cold should

should in rease or diminish. Which rule of theirs had beene very certaine, were there no other causes concurrent in the disposition of the Earth and Ayre, but onely the Heauens. But since that many other concurrent causes, as we haue shewed, mixe themselves with these celestially operations, and the experiment of Nauigatours haue found out a disproportion in the quality, in respect of the Distance, some later writers haue sought out a new partition more consonant to naturall experience. The whole Latitude of the Hemisphære consisting of 90 Degrees from the Equatour to the Pole, they haue diuided into three parts, allowing 30 Degrees toward the Equatour to Heat; 30 Degrees towards the Pole to Cold; and the other 30 Degrees lying betwixt both to Temperature. These 30 Degrees for Imagination sake they haue subdiuided againe, each of them into two parts contayning 15 Degrees a peece: more particularly to designe out the speciall disposition of each Region, lying either Northward or Southward from the Equatour, which is the bound betwixt both Hemisphæres. In the first section of 30 Degrees lying Northward from the Equatour, wee comprehend in *Africke*, *Numidia*, *Nigritarum Regio*, *Lybia*, *Guinia*, *Nubia*, *Egypt*, *Ethiopia superior*. In *Asia*; *Arabia*, *India*, *Insula Philippina*. In *America*, *Noua Hispania*, *Hispaniola*, *Cuba*, with other parts of *America Mexicana*. In the other extreame section from 60 Degrees of Latitude to the Pole, wee comprehend in *Europe*, *Groenland*, *Island*, *Friesland*, *Norway*, *Suetland* for the most part, *Noua Zembla*. In *Asia*, a great part of *Scythia Orientalis*. In *America*, *Anian*, *Quivira* with diuerse other parts of the North of *America Mexicana*. In the middle betwixt both, betwixt 30 and 60 Degrees of Latitude wee comprehend in *Africa*, *Barbarie*; in *Europe*, all the kingdomes except those North Prouinces before named, and almost all *Asia*, except some places toward the South, as *Arabia*, *India*, and the *Philippina Insule*, formerly placed in the first Section; In like manner may we diuide the Southerne Hemisphære into three Sections: In the first, from the Equatour 30 Degrees we place in *Africke*, *Congo*, *Monomotapa*, *Madagascar*: In the Southerne Tract, *Beach*, and *Noua Guinia*, with many

ny Ilands thereunto adioyning, as many of the *Philippine Insula*, with *Insula Solomonis*. In *America*, *Pernu*, *Tifnada*, *Brasilia*, with the most part of that Region which they call *America Peruana*. In the other extreame Section from 60 Degrees to the Antarctike Pole, is couched the most part of that great land scarce yet discovered, called *Terra Australis Incognita*. In the middle Region betwixt both, from 30 to 60 Degrees, shall wee finde placed in *America*, the Region of the *Pannagones*, in the Southerne Continent, *Maletur*, *Jauaminor*, with many others. In discovering the qualities of these severall Sections or partitions of the earth, our chiefeft discourse must be addressed to the Northerne Hemisphere, as that is more discovered and knowne amongst old and new writers; by which according to the former Proposition one may parallell the other; concerning which wee will inferre these Propositions.

1 In the first Section of the Hemisphere the first 15 Degrees from the Equatour are found somewhat Temperate; the other 15 about the Tropicks exceeding Hot.

That the Region lying vnder the Equatour is Temperately hot, contrary to the opinion almost of all the Ancients, hath beene in part proued heretofore, as well by reason, as experiment: for that all places by how much the neerer they approach the Equatour, by so much more should bee hotter (as some imagine) diuerse instances will contradict. It is reported by *Aluarez* that the *Abyssine Embassadour* arriuing at *Lisbone* in *Portugall*, was there almost choaked with extreame heat. Also *Parquer* the Germane, relates that hee hath felt the weather more hot about *Dantzicke*, and the *Balticke* Sea, then at *Tholouse* in a feruent Summer. The causes which wee haue before touched, are chiefly two. The first is, that the Sun is higher in this orbe in respect of those vnder the Equatour, and moueth more swiftly from them, spending on them onely twelue houres, whence so great an impression of heat cannot bee made as in other places: for heat being a materiall quality, must necessarily

cessarily require some Latitude of time to bee impress into the ayre, or any other subject. From the Diminution of heat in the Region must the ayre needs receaue into it selfe the contrary quality of cold. An argument of cold may bee drawne from the testimony of *Alvarez*; who affirms the waters there in the month of Iune, to bee frozen ouer with Ice, the South winde blowing. The second cause is by iudicious writers, ascribed to the subtilty and rarity of the Aire vnder the Equinoctiall line, which cannot receaue into it selfe so many degrees of heat as the thicke and grosse aire of diuers places distant. For the North Region; wherein *Europe*, and a great part of *Asia* is placed, is for the most part full of waters, which burling out of secret and vnknowne concavities, doe produce infinite *Fennes*, *Gaggess*, *Lakes*, and *Marishes*, which in the Summer season cause infinite vapours to abound, which being intermixed with heat, scorch and heat mote feruently then the purer ayre of *Africke*, being for the most part free from the mixture and conourse of such stinie vapours. That the aire being thickned should yeeld a greater feruour, euery man out of ordinary experience can frame to himselfe an argument: For wee see Fire and Heat being incorporated (as it were) in the Steele or Iron, to burne and heat more then in Aire or Wood. The like reason some would draw from the keepers of Stoues or Hot houses; which doe besprinkle the ground with water, that the vapour being contracted and the aire thickned, they may the longer and better maintaine heat and spare Fuell. Another cause (which we haue formerly touched) may bee drawne from the *Set* and *Anniuer*-windes which blow most part of the yeere one way. *Iosephus* *Acosta* obserues that betwixt the Tropicks, the winde is for the most part Easterly, beyond Westerly: and a Dutch-discoverer hath related that in *Guinea* they haue a certaine winde which comes from the land till noone: and then very violent from the Sea, in so much as the Inhabitants are wont to trafficke in the morning being not able to indure it: which if it bee true wee cannot imagine this Region to bee so hot as men suppose. For here the heat in the night is asswaged, by the absence or remotenesse of the Sunne: Likewise the excesse of heat incident

to noonetide, is much qualified (or as it should seeme by this relation) altogether vanquished by the cold winde deriued from the Sea. Another reason no lesse probable may be deriued from the excessive height of the land and great mountaynes, obserued to bee neere or vnder the line, whose tops are alwayes couered with Snow, which giue a sufficient testimony of cold. For instance, wee need goe no farther then the ridge of the mountaines *Andis in America*, where they obserued the Ayre to be so thicke and cold, that it inforced them to scowre and vomit, which came neere it. The like whereof is related of another called *Pumas*, where the extremity of cold cutteth off their hands. From which experience wee may finde some places neere the Line to bee more infested with cold then heat. The last and greatest reason may bee taken from the continuall moisture wherewith the regions situate betwixt the Tropicks frequently abound. This moisture is deriued from two causes; 1 From the melting of the Snow on the tops of the mountaynes by the Sunne, which running from thence continually into the vallies, keepe them almost alwayes watrish, especially in the midst of Summer when the Sunne is neereest. 2 From the extreame heat of the Sunne, which being very neere, and many times verticall, rayseth vp continually moist vapours in great quantity. These vapours in so short a time as 12 houres, being not consumed but meeting with the cold from the middle Region of the aire, are therewith conuerted into drops, which fall downe againe in great showres: in so much as some trauellers of good credit haue told me, that all the while they layed betwixt the Tropicks, they seldome saw the Sunne, by reason of raine and cloudy vapours. Whence wee note with *Iosephus Acofta*, by way of consectary, that the presence of the Sunne betwixt the Tropicks produceth moisture, but contrariwise without the Tropicks, it is the cause of drouth: whence the inhabitants inioy as it were a Winter, when the Sun is to them verticall, because of the distemperature by Windes, Raines, and Stormes, and great Innudations, whereunto commonly all great riuers betwixt the Tropicks are most subiect. Also they seeme to haue a Summer, when the Sunne is in or neere the Tropicks because

because being somewhat remoued, he cannot bee so powerfull in drawing such store of vapours and exhalations which hee can dispell and consume. Thus wee see the moiety of this first Section lying 45 degrees from the Equatour, howsoever subiect to a greater reflection of the Sunne-beames, yet through the concurrence of other causes to bee found indifferently Temperate, and the other 15 degrees about the Tropicks, howsoever subiect to a lesser Reflection to bee excessive hot: which later cause, besides all which hath bene said before, shall bee further confirmed hereafter by the complection of the native Inhabitants; which wee shall finde to bee *Choller-adust*, the true symptome of an externall heat. But if any man shall answer that this accident is incident as well to the Regions situate vnder the Equatour, as to that vnder the Tropicks, I will produce another reason drawne from the colour of their countenances; which vnder the Equatour is not seene so blacke and swarthie as elsewhere. For toward the Tropicke, is placed the Land of *Blackmores* or *Nigritarum Regio*, where the people are all coleblacke: which might perhaps happen also to those that dwell vnder the other Tropicke; but that other causes interpose themselues, which hinder the excesse of heat, which is taken to be the chiefe cause of this blacknesse; Here some would oppose the opinion of *Herodotus*, which referred the cause of this blacknesse in the Negroes, to the Seed which hee would haue to bee blacke: others would haue this blacknesse as a curse inflicted vpon *Chams* posterity: but these opinions carry very little shew of probability. For first, if this former opinion were admitted, it would of necessity follow (saith *Boden*) that *Ethiopians* in *Scythia* should alwayes bee borne blacke, and *Scythians* in *Ethiopia* should bee alwayes white. For as much as all nations from the beginning of the world haue bene confused and mixt by the distinction of Colonies: but experience teacheth vs, that men trasplanted into another Soyle, will in manner of trees and Plants by little and little degenerate and change their first disposition. As if a *Blackmore* marry and beget children here with vs in *England*, experience will plainly declare the children to be more inclining to whitenesse then the fathers and

and the grand children more then them. Secondly, if the second opinion of *Chams* curse deserued any credit; I see no reason why all his posterity (such as by most writers consent, are generally the people of *Africke*) should not bee subiect to the same execration, as well as one little parcell of it. Moreouer it is reported by *Pline*, and confirmed by *Appian*, that in those places are many blacke Lions, which we can ascribe to no other cause then the excesse of heat, and not to any quality of the Seed, or any curse inflicted on the place: Moreouer it is reported by *Ferdinando de Lyur* in his late discouery of the South Continent, that hee there also found some blacke people; yet can wee not imagine this Land, though stretching very farre in quantity toward the Equinoctiall, to come so farre or much farther then the Tropicke of *Capricorne*. These arguments make it the more probable that the Regions situate vnder the Tropicks, generally exceed more in heat, then those placed in the middle of the Earth vnder the Line.

- 2 In the other extreame Section from 60 Degrees towards the Pole, the first 15 Degrees towards the Equatour are more moderately cold; the other towards the Pole most immoderately cold, and vnapt for conuenient Habitation.

That this Section of 30 Degrees comprehended betwixt the 60 Degree and the Pole, is in a sort habitable, is confirmed by the testimony of many Nauigatours, especially the *English* and *Hollanders*; who haue aduentured very farre Northward, and haue there found the Earth, though not so fruitfull, yet furnished with some commodities, and peopled with Inhabitants. The first 15 Degrees towards the Equatour admit of no great exception, containing in their extent *Finmarke*, *Bodia*, in *Scandia*, *Nova Zembla*, *Anian*, *Groenland*, with many other places indifferently discovered: where they haue indeed found the aire very cold in regard of this of ours: Yet not so Immoderate,

but that it can at all times agree with the naturall temper of the native Inhabitants, and at least at some times of the yeere admit a passage for forraigne Nations. But the other Region stretching Northward from 75 Degrees to the Pole it selfe, howsoever it may bee probably thought habitable, yet affords it no conuenient meanes and sustenance for mans life, in respect of other places; neither can the people of this climate inioy any good complexion or Temperament of the foure qualities; for as much as the cold with them is so predominant, that it choaketh, and almost extinguisheth the naturall heat: whence *Hypocrates* saith that they are dried vp, which is a cause of their swarty colour, and dwarfish stature; which assertion of his can obtaine no credit, but of such Northerne people as liue neere the Pole. Neuerthelesse wee shall not finde these poore Northerne Nations, so destitute altogether of vitall aides, but that their wants are in some sort recompensed by the benefit of nature. The chiefest comforts in this kinde, which wee inioy, and they seeme to want, are *Heat* and *Light*. The defect of heat is somewhat mollified; 1 By the Sunne staying so long about their Horizon as 6 months, and by consequence impressing into the Aire a greater degree of heat. 2 By the naturall custome of the Inhabitants, neuer acquainted with any other temperature: both which reasons wee haue formerly alleaged. 3 By the industrie of the Inhabitants, being taught by necessity to preserve themselves during the Winter-time in *Caves*, *Stones*, and such like places heated with continuall fires: the defect of which providence, was thought to bee the ruine of *Dr. Hugh Willoughby*, intending a search of the North-east passage on the North of *Lapland* and *Russia*. To recompense the defect of Light, Nature hath provided two wayes: 1 In that the Sunne in his Parallell comming neerer and neerer to the Horizon, gives them a long time of glimmering light both before his rising and after his setting: which may serue them instead of day. 2 For that the Sunne and Starres by reason of a refraction, in a vaporous and foggy Horizon, appears to them sometime before hee is truly risen: which caused the *Hollanders* *Nous Zembla*, to wonder why they should see the Sunne diuerse dayes before according

According to their account hee was to rise about their Horizon according to Astronomical grounds: which probleme had staggered all the Mathematicians of the world, had not the Perspective science stept in to giue an answer.

- 3 In the middle Section betwixt 30 and 60 Degrees of Latitude, the first 15 are Temperately Hot, the other 15 more inclined to Cold.

The middle Region partakes a mixture of both extreames, to wit, of the cold Region towards the Pole, and the hot towards the Equator: whence it must needs follow, that the more any parts of this Tract approach the hot Region vnder the Tropicke and Equator, the more it must partake of Heat: yet this heat being mitigated by some cold by reason of the site of the Sunne, it must of necessity bee Temperate and very apt for humane habitation. Also this mixture of the cold quality being more extended and increased on the other moiety towards the Pole through the vicinity of the cold Region, must loose much of the former heat, which shall hereafter bee more confirmed out of the naturall constitution and complection of the Inhabitants; bearing the true markes of externall cold and internall Heat, whereof the one is strengthened by the other: For the externall cold, if it be not ouer predominant, and too much for the internall Heat, will by an *Antiperistasis* keepe in and condensate this heat, making it more feruent and vigorous.

- 6 The East and West Hemispheres are bounded and diuided by the Meridian passing by the *Canaries* and the *Molucco* Ilands.
- 7 The East Hemisphere reacheth from the *Canaries* the *Moluccoes* on this side; as the other on the opposite part of the Spheare.

Wee may here note a great difference betwixt this diuision and the former. For the North and South Hemispheres being diuided by the Equatour, are parted (as it were) by Nature it selfe, and the Sunnes motion; But the diuision of the Globe into East and West, wee can ascribe to no other cause, then mans Institution: yet are the Easterne and the Westernne found to differ many wayes, the discouery of which may giue great light to obseruation.

1 *The Easterne Hemisphere wherein we liue is euery way happier and worthier then the other Westward.*

How farre short the Westernne Hemisphere comes of this of ours, many circumstances may declare. For first, if we compare the Quantity of Land, wee shall finde a great disparity. For the Westernne Hemisphere contains in it besides the Southerne Continent (wherein ours also claimes a moiety) onely *America*, with the Ilands thereunto adioyning: whereas the other within this large circuit contains all the other parts of the Earth knowne vnto the Ancients, as *Europe*, *Asia*, and *Africke*, with many Ilands to them annexed. Moreouer it is probably conjectured by some, that *America* is vsually on our Mappes and Globes, especially the more ancient, painted and delineated out greater then indeed it is: which hath beene ascribed to the fraudulent deceit of the *Portugalls* heretofore; who to the end they might reduce the *Molucco* Ilands to the *East Indies*, then their owne possession; fought as well in their Mappes as relations to curtaile *Asia*, and inlarge *America* in such sort, as the *Molucco* Ilands might seeme to fall within the 180 Degrees Eastward, wherein they fed themselves with vnknowne substance, and the *Castilians* with painted shadowes. But to let passe the quantity as a matter of lesse moment and lesse questioned; a great disparity will bee found in the *Quality* and *Disposition*: For what one commodity almost was euer found in this Continent, which is not onely paralleled, but surmounted by this our Hemisphere? If we compare the Mines of Gold and Silver wherein consists the wealth and riches of both places; our *East Indies*.

Indies will easily challenge the superiority. If *Trees*, *Plants*, *Herbage* and *Graines*, let our Physicians and Apothecaries iudge, who owe most of the medicinable drugges to *India*: Let our Merchants answer, which owe their Spices to *Arabia*, their Wine, to *Spaine*, *Italy*, the *Mediterranean*, *Gracian*, and *Indian* Islands; their Silkes, Linnen, Cloathing, and their furniture almost wholly to *Europe*. If wee compare the multitude and various kinds of Beasts bred and nourished in either place, no question but *Europe*, *Asia*, and *Africa* can shew farre greater Heads of *Sheepe*, *Cattle*, and such like, with farre greater variety of kinds, then euer were found in this new found Continent. If all these failed, yet the well tempered disposition of the *Europeans* and *Asians* in respect of this barbarous and vnnurtured place, distaines all comparison: where wee shall obserue on the one side a people long since reduced to ciuility, instructed as well in liberrall sciences, as handy-crafts, armed with martiall discipline, ordered by Lawes and ciuill government, bound with a conscience and sense of Religion; on the other side a multitude of miserable and wretched nations, as farre distant from vs in ciuility, as place; wanting not only *Government*, *Arts*, *Religion*, and such helps, but also the desire, being senselesse of their owne misery.

2. *The difference of East and West cannot worke a diuersitie in two places by any diuersity of the Heauens.*

East and *West* places compared together, are either of equall or vnequall Latitude. For places of vnequall Latitude no question can bee made, but they receaue a greater variety of Temper from the Heauens; as wee haue formerly proued: but this disparity growes not out of the diuersity of East and West, but the distance of North and South. But that places alike situate in Latitude, cannot vary by any diuersity of the heauens is plaine; for as much as all things to them rise and set alike, without any diuersity: wherefore, if any such diuersity bee at any place found, we ought not to seeke the cause thereof in the hea-

uens, but rather in the condition of the Earth it selfe, which no question suffers in diuerse places of the same Latitude a great variety.

8 Either Hemisphere may againe Respectively be subdiuided into the *West* or *East*. The *West* in this our Hemisphere I call that which is neerer the *Canary Ilands*; the *East* that which lieth towards the *Molucco Ilands*; to which points there are others correspondent in the other Hemisphere.

1. *Places situate towards the East in the same Latitude, are hotter then those which are placed towards the West.*

For the explanation of this Theoreme, we are to examine two matters; First, what probability may induce vs to beleue the East to bee hotter temper then the West. Secondly, what should bee the cause of this diuersity in both places, being supposed equally affected, in respect of the Heauens: for confirmation of the former, many reasons haue beene alleaged of old and late writers. It is agreed on (saith *Bodin*) with a ioint consent of the *Hebrewes*, *Greeks*, and *Latines*, that the East is better tempered then the West: which hee labours to confirme; First, out of many speechies of *Ezekiel*, *Esay*, and the other Prophets, where the East seemes to challenge a dignity and prerogative aboue the West; which betokeneth (as he imagines) a blessing of the one aboue the other. But I dare not venter on this Interpretation without a farther warrant. Secondly wee may here produce the testimony of *Pliny* in his sequenth booke, where hee affirms that by ordinary obseruation, it is found that the pestilence commonly is carried from the East into the West, which *Bodin* testifies himselfe to haue found by experience in *Galia Narbonensis*, and many other history seems.

seemes to iustifie. *Amianus* a Greeke Author, obserues that *Selencia* being taken, and a certaine porch of the Temple being opened, wherein were shut certaine secret mysteries of the *Chaldeans*; that a suddaine contagion arose of incurable diseases, which in the time of *Marcus* and *Vernus* from the farthest ends of *Persia*, spread it selfe as farre as the *Rhene* and *France*, and filled all the way with heapes of carcases. If at any time the contagion bee obserued to bee carried another way, an vninerfall pestilence is feared: as according to the histories there happened not long after from *Ethiopia* towards the North, which infested the greatest part of the world. A third prooffe may bee drawne from the testimony of *Aristotle*, *Hippocrates*, *Galen*, *Cresius*, and other graue Authors, who affirme that all things are bred better and fairer in *Asia* then in *Europe*, which must needs argue a better temperature: To backe which Testimonies, we need goe no farther then moderne obseruation. Euery Geographer will tell you how farre in fertility *Nazolia* in *Asia* surmounts *Spaine*; and *China*, vnder the same Latitude exceeds both: who knowes not how farre *Fez* and *Morocco* on the Westerne Verge of *Africa*, stand inferiour to *Egypt*, a most fruitfull and happy Region? And how farre short both these come of *India*, situate in the same Climate. An argument of greater heat in the Easterne places may bee the multitude of Gold and Silver-mines, Spices, and other such like commodities, wherein *Asia* excells *Europe*: whereas such metals and commodities as require not so great a measure of heat in their concoction, are rather found in *Europe* then in *Asia*; whence there seemes to arise a certaine correspondency of the East with the South, and the West with the North. The greatest reason of all is taken from the Temper and naturall disposition of the Inhabitants, for as much as the *European* resembling the Northerne men, shewes all the Symptomes of inward heat strengthened with externall cold. The *Asiaticke* follows the disposition of the Southerne man, whose inward heat is exhausted by externall scorching of the Sunne-beames, and therefore partakes more of Choller-adust or melancholy. But this point wee shall more fully prosecute in due place. To shew a cause of this

variety is very difficult. Those which in wit and learning haue farre exceeded my poore scantling, haue herein rather confessed their owne ignorance, then aduentured their iudgement. It were enough to satisfie an ingenious minde, to beleue that Almighty God was pleased in the first creation of the world to endow the Easterne part of the Earth with a better temper of the Soyle, from whence all the rest deriue their originall: which seemes not improbable, in that he made *Asia* the first resting place of man after the Creation, the second Seminary of mankind after the Deluge, the onely place of our *Sauours Incarnation*. In this matter I beleue no lesse, and can speake no more, except I should vrge the beating of the great *Atlantick* Ocean vpon our Westerne shoares; which may in some sort qualifie the excessse of heat incident to the Easterne tract, which may produce some degrees of Temperature. But here also wee shall perhaps meet with crosse instances, which will stirre vp more doubt then satisfaction.

CHAP. IV.

Of the manner of Expression and Description of Regions.

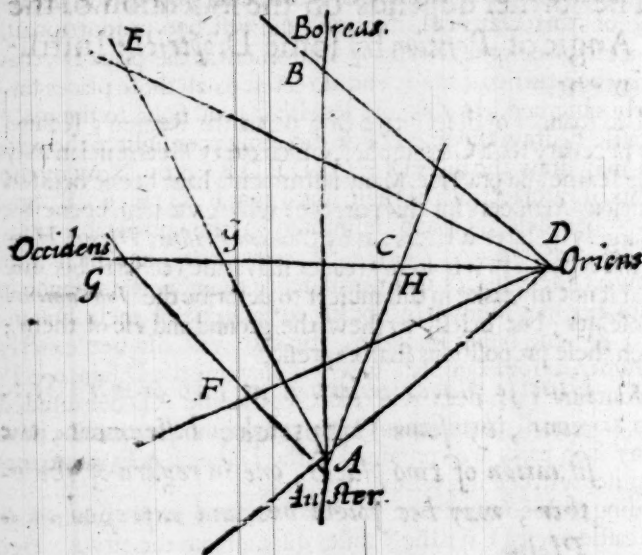
I Having treated of the generall Ad-
 iuncts of places, wee are next to
 handle the manner of describing a
 Region, which proposeth vnto vs two points,
 1 the finding out the *Position* of two places,
 one in regard of the other. 2 The *Translation*
 of such places so found out into the Globe or
 Charte. 2 The

2 The former depends on the inuention of the Angle of *Position* by some *Dioptricke* Instrument.

This manner of description of a particular Region, seemes very necessary for a Geographer, which euery Mechanician may soone learne and practice. Many instruments haue bene deuised by curious Artificers for this purpose: whose vse hath bene set out largely by later writers, as by *Gemma Frisius*, *Diggs*, *Hopton*, and others: to whom my reader may haue recourse, because I hold it not my taske in this subiect to describe the Instruments themselves; but briefly to shew the ground and vse of them; which these propositions shall expresse.

1 *Diuerse places obserued at two or more Stations, by some Dioptricke Instrument, the situation of two places, one in regard of the other, may bee found out and expressed in a Plaine.*

This may sensibly bee shewed in the Figure following: to expresse which the more plainely, wee will set downe these Rules: 1. Let there bee drawne in some Chart or plaine plarforme, a right line, which wee must accompt to bee our Meridian; because it shall afterward serue for that purpose. This right line shall be A B, whose two ends A and B shall bee taken for the North and South. 2. You must choose out of some high place, as a *Towre* or *Mountaine*, from whence you may behold such cities, townes, castles, and other such notable places whereof you desire to know the situation and bearing of the one to the other: This High place is called the *First Station*; where you must place the plaine before prepared in such sort, as it may Astronomically and truely agree with the true Meridian of the place (whose inuention we haue taught in the first Booke) and so respect the foure Cardinall coasts, to wit, *East*, *West*, *North*, and *South*: Vpon this place seated in such a manner



ner of situation fasten your *Dioptricke* instrument, that it may bee turned about the point A on every side at pleasure, in such sort, as the sight may be directed to euery one of the adjacent places. First then remouing it from A, direct your sight to F, and draw the line A F of indefinite length: likewise your Instrument being directed to G, draw the line A G infinitely, which by this meanes will also hit the place E: Let B also bee imagined a certaine place, as a City, or Castle, situate in the very Meridian it selfe, which wee find already drawne to our hands. In like sort ought wee to proceede with the other places C and D, and as many as we please.

This performed, you must remoue your selfe with your Instrument and Plaine to some one of these places thus fore-marked out; as for example vnto D, which is called the *second station*, and there as in the former, ascending vp some high place, the Plaine being first fitted and placed *Astronomically*, take the

the distance AD of any length whatsoever, for to the greatness of this Distance, shall all the rest bee proportionall. Hence so place your *Dioptricke* Instrument at the place D, that it may bee turned round, and directed to all those places formerly obserued. In this sort leuelling your sight to the place or castle F, draw the line DF: so directing your sight to the rest, you may draw the lines DCG, DEDB; &c. Now by the points of Intersections of these lines, as in F, G, E, C, B, &c. are to bee described and delineated out the said notable landmarks, as *Townes*, *Castles*, *Promontories*, and such like. Betwixt these places if any man desire to know the distance in miles, hee may know it by finding out any one of these Distances; for one being knowne, the rest will also bee exactly knowne; as for example, wee will imagine the Distance AD to containe 10 miles: wherefore let the line AD bee diuided into 10 equall parts: then with your compasse examine how many such parts are contained in the Distance AF, for so many miles will bee likewise in it contained: as for example according to this supposition wee shall find it 5 parts: wherefore the castle or city F will be 5 miles distant from the city A. Hee that desires more particularly to acquaint himselfe with the vse and diuerse manners of descriptions of Regions, deriued from this one ground; Let him haue recourse to diuerse Authors who haue particularly laboured in this subject; amongst which our two *Englishmen*, *Digges*, and *Hopton*, deserue not the least praise: whereof the later, out of these principles hath framed a curious instrument, which hee calls his *Topographicall-Glasse*, whose vse hee hath perspicuously and exactly taught in diuerse pleasant conclusions, too large for the scope of my methode to insert.

2. *At one Station by optically obseruation, the situation of one place in respect of the other may bee found out.*

This may bee shewed out of an optically experiment, both pleasant and admirable: The ground is expressed in this proposition:

sition: The light traieſſed by a narrow hole into a darke place, will represent in any Table or white paper within, whatſoener is without directly opposed unto it: For demonſtration of which propoſition, wee muſt take as granted of the *perſpective* Authours, That the viſuall Image or ſpecies will paſſe by a right line through any little hole, and will bee terminated in any point of the *Medium*: Now that it ſhould more perſpicuouſly bee ſcene in a darke place, then in the light. The cauſe is aſſigned to bee, becauſe the light of the *Sunne* is taken away, or much diminiſhed, which otherwiſe would hide and ſhadow the *ſpecies* of the thing which is preſented to the ſight; as wee ſee by experience the greater light of the *Sun* to obſcure the *Starres*: which neuertheleſſe from the darke bottome of a deepe *Well* or *Mine*, will ſhew themſelues at mid-day. Neuertheleſſe wee muſt obſerue by the way, that this representation of any thing to the ſight by this Image impreſſed in this ſort in a wall or paper, will ſhew it ſelfe ſo, as the parts will bee ſcene inuerſed, or (as wee may ſay) turned on the contrary ſide: as the *higher*, *lower*, the *lower*, *higher*; the *right-side*, to the *left*; and the *left*, to the *right*: which we may declare by an ocular demonſtration in this

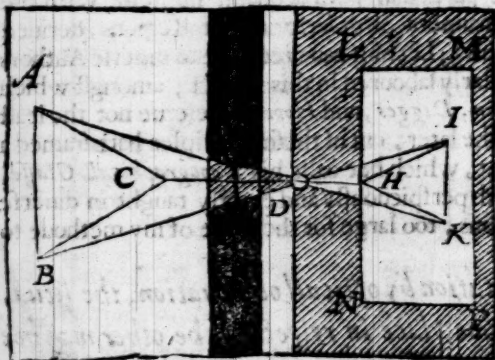


figure heere inserted: Let vs imagine a Triangular platforme of land, whereof we deſire to know the ſituation, to bee A B C: from the extreame Angles of this Triangle, we

will ſuppoſe certaine Rayes to bee drawne through the hole D into a darke place, wherein ſhall bee opposed to the hole D, a white Table or paper, which ſhall be NM: Here will

a Ray

a Ray from the point designing out the Angle at A, bee carried through the hole, that it will point out in the Table K (because all such beames according to the *Opticks* are right lines.) Likewise the Angle B will in the Table designe out the Point I: also C will fall into the point H: Let KH, IK, HI, beioyned together by right lines, there will appeare the Triangle I K H: wherein the top of the Triangle A will bee seene in the lowest place K: Likewise the Angles of the *Basis* B and C, will appeare in the points of the highest place H I: and the right side A C, will shew it selfe in the left H K: as the left side will be the right in I H: wherefore the side of the whole Triangle A B C will shew it selfe in the Table N M, although inuersetly placed according to the sides and Angles: and of a various greatnesse in respect of the distance of the Table from the hole. The inuention hath great vse in *Astronomy*, in observing *Eclipses*, the beginning, and continuance, without any hurt at all to the sight. No lesse vse may it challenge in *Topography* in describing of *Territories*, *Cities*, *Borowes*, *Castles*, and such like, in their due symmetry and proportion: To practise which the better, *Reusner* would haue a little house built of light Timber, with a *Muliangle Basis*: in euery one of whose sides, a hole should be made, looking inwardly, at the *vertex*, or top, but outwardly at the *Basis*: through which the species or Image of all such things as are visiblie may haue free passage.

- 2 The manner of translation of a Region into the chart, depends from the knowledge of the *Longitude* and *Latitude*.
- 3 The parts to bee described, whereof the chart consists, are either *Essentiall*, or *Accidentall*: The *Essentiall*, are either the *Lines*, as are the *Meridians* and *Parallels*: or the *Places* to bee delineated out by Pictures;
The

The declination of both which, shall be taught in these rules.

I To set downe the Meridians and Parallels in a particular chart.

To shew the practise hereof, wee will take for instance the Region of *France*, an example familiar with our later *Topographers*, and therefore can better warrant the description: *France* is supposed to haue in latitude 10. degrees, in longitude 16: This knowne, you must proceede in this manner: First through the middle of your table from head to foote, let there bee drawne a perpendicular line expressing the Meridian of the world, which shall bee marked with the letters E F: let this line bee diuided into 10. equall parts: then draw two *Parallell* lines, whereof the one must crosse the said line about the point E with right Angles: and the other *Parallell* must crosse it againe beneath in the point F with like Angles: let the vppermost *Parallell* bee expressed by A B: The neathermost with C D: Then with your compasse take one of the 10 parts of the line E F, which is one degree, and set that downe apart by it selfe, diuiding the same into 60 Minutes, as the short line G H, in the table here inserted will shew on the right hand. Now you may learne by some Table or Mappe, that the farthest part of *France* toward the *North*, through which is drawne the *Parallell* A B is 52. degrees distant from the Equatour: And that the South *Parallell* C D, is distant 42 degrees: Also certaine Tables in our former booke will informe you, that to euery degree of the *Parallell* 42. delineated by A B, doe answer 37 miles: and that to euery degree of the *Parallell* C D, answer 45. miles: wherefore with your compasse take from the short line G H, 37 partes or Minutes, and with your compasse kept at the same largenesse, let the *Parallell* A B bee diuided into 16 equall spaces correspondent to that widenesse (that is to say) on each side of the Meridian 8 parts: at which Meridian E F, you must begin your measure towards either hand both right and left, marking

marking the end of every such space with a certaine point: Moreouer for the South *Parallel* CD. let 45 parts likewise bee taken from the short line GH, and let that *Parallel* bee diuided into 16 spaces, correspondent to that widenesse of the compasse, eight spaces being set downe on each side of the *Meridian* EF: So that wee must beginne from the *Meridian* EF, and marke the end of every such space with a point. Then from those points wherewith each of those two *Parallels* AB, and CD is marked; Let there bee drawne a right line from point to point, and those shall serue for *Meridians*, expresseing as well the longitude of the whole Region, as of every particular place therein seated. In like sort as you haue diuided the *Meridian* EF, into 10 equall parts, so againe into the like number of equall parts must bee diuided each of the two vttermost *Meridians*, on the left hand and the right, marking with a point the end of every such space, and so from point to point let there bee drawne right lines, cutting all the *Meridians*, and those shall serue for *Parallels*, and in the vttermost spaces, let there bee written the numbers of *Longitude* and *Latitude*. The *Longitude*, is supposed to beginne at the vttermost *Meridian* at the left hand, which in both *Parallels* is the farthest *Meridian* Westward. Now for as much as the most Westerly *Meridian* is foueteene degrees distant from the *Meridian* passing by the *Canary* Hands, from which as the first *Meridian*, the auncients beganne their accompts: you must set downe in the first place on the left hand, as well ouer, as vnder in the first space 15, in the second 16, in the third, 17, and so orderly proceed through all the spaces, till you come to 30: For the difference betwixt 14 and 30, is 16: So you haue the whole *Longitude* of France expresseed in your Table, which is 16 degrees: In the like sort to expresse the *Latitude* (haueing the degrees of *Latitude* marked out) you must beginne at each end of the South *Parallel* CD, and so proceed vpward in the two vttermost *Meridians*, writing downe in the first space at the foot of the Table 43 degrees, on the right hand and the left, in the second space 44, in the third 45, and so vpwards along to 52, so haue you expresseed the whole *Latitude*.

itude of France from North to South : for betwixt 42 and 52 are comprehended iust 10 degrees : These degrees may againe be diuided at pleasure into lesser parts , as minutes , according to the largenesse of your chart.

2 To set downe Citties , Castles , Mountaines , Riuers , and such like speciall places in the chart.

The platforme of your chart being once drawne out , as wee haue formerly taught in the precedent rule , you may very easily set downe speciall places by obseruation of the Longitudes or Latitudes of such places , either by instruments or Tables , and reducing them accordingly to your chart : which wee suppose before , marked out according to seuerall degrees : As for example , if wee would set downe in our chart the *Metropolis* of France , which is *Paris* : hauing recourse to my Table , I finde it to hane in *Longitude* 23 degrees , in *Latitude* 48 degrees. Here to finde out the said longitude you must extend a threed from the 23 degrees of the *Parallell* A B to the like degree in the *Parallell* C D : then holding it fast , you must crosse that threed with another extended from the *Meridian* A C , to the *Meridian* A D in the points of 28 degrees : The point wherein these two threeds shall cut and crosse one the other , you may take for the true place of *Paris* , and marke it out in your chart : In like sort you may proceede with all other places. But if you were to describe a riuer in your chart , it will not bee sufficient to take the *Longitude* and *Latitude* of the beginning or fountaine , but of the end , middle , turnings , and angles , Townes , or Cities , by which it passeth , Bridges and other occurrent circumstances : In like sort may you set downe *Woods* , *Forrests* , *Mountaines* , *Lakes* , and other places whatsoeuer.

4 Thus much for the *Essentiall* part of the particular Chart : The *Accidental* part wee call the *Scales of Miles* , which teacheth how many

many miles are contained betwixt any two places in the Chart, wherein we are to know two things, 1 The *Fabricke*; 2 The *Vse*.

- 1 The *Fabricke of the Scale depends from the certaine knowledge of the Distance of any two places in the Chart.*

The practise is very easie, and taught in these three Rules:


- 1 You must search out the distance betwixt any two places whatsoever, which are contained in the Region, described in your Chart: which you may doe either experimentally by your owne knowledge, or some certaine relation of Trauailers.
2 Then must you draw three *Parallell* lines, containing two spaces, one larger, the other lesser, in some void space of your Chart.
3 You must diuide the said *Scale* into so many Miles, as the said void space will giue you leaue, according to the known distance first found out: As for example, the distance betwixt *Paris* and *Roane* is knowne to be 30 *French leagues*, which contains 60 of our Miles, allowing for euery such league, 2 Miles. Wherefore your *Parallell* lines being first drawne (as you see in the former Chart) diuide your *Scale* into 30 parts accordingly, and in the larger space, place your Numbers, as 10. 20. 30. and so forth, so farre as your space will conueniently extend.

- 2 The *Distance of any two places set downe in the Chart, being taken and applyed to the scale, will shew how many miles it containes*

As for example, I would willingly know how many *English Miles* are contained betwixt *Paris* and *Orleans* in my Chart of *France*: Here I take with my compasse the distance betwixt the said Cities in the Chart, and applying that to the *Scale*, I find it to containe 50 miles: which is the true measure.

C H A P. V.

Of Hydrography.

1  hitherto haue we treated of the *Generall Adjuncts* and Proprieties of places in the Terrestriall Spheare: we are in the next place to handle the *Distinction*.

2 A place is generally distinguished into *Water* and *Land*: The Description of the former is termed *Hydrographie*; The other for distinction we call *Pedography*.

3 *Hydrographie* is a Description of the *Water*, with the *Accidents* thereunto belonging.

The *Water* wee consider not here meerely *Physically*, as it is an Element, whereof mixt bodies are compounded; but *Topographically*, as it beares a part in the Terrestriall Globe: yet are wee not so curious to exclude such *Physicall* problemes and considerations as are most subiect to sense; which a *Topographer* cannot well neglect: being the *markes* and characters, designing out speciall places: To finde out the originall of the *Water*, wee must first take as granted, that Almighty God (as wee reade in the first of *Genesis*) in the beginning made a separation betwixt the waters *aboue* the Firmament, and the waters *under* the Firmament; whereof the former is termed in the Scriptures *רקיע*, which is as much to say as *expansum*, a thing stretched out, or extended. By these waters *aboue* the Firmament, whether wee ought to vnderstand the *cloudie vapours*.

pours in the middle Region of the Aire : or the pure fluid and liquid body, whereof the Firmament consists ; I leaue it to learned diuines and criticke expositours to dispute : although the propriety of the phrase (if it bee well rendred) will seeme to fauour this opinion rather then the other : for as much as the Aire can no way bee said to bee about the Firmament , except the *Hebrew* terme miscarry in the Translation. For the solidity of the Celettiall Orbs , which *Aristotle* labours to confirme , is found long since to thwart the obseruations of *Astronomers* : although it may thus bee retained as vsfull *suppositions* to settle Imagination. But to let this passe , and come to the waters vnder the Firmament , vnderstood by the word מַיִם , which signifies as much as a collection of waters : wee shall find them to haue taken their originall from the separation of the waters substance from the Dry-land , caused by God in the first Creation , testified by *Moses* in 1 *Gen*: which once granted (as no Christian can deny) easily rebates the edge of the opinion of some auncient Philosophers , who contended , out of the nature of *Drouth* and *Moisture* , to deriue the beginning of this separation. The drynesse of the Earth (say they) working by little and little , diminisheth , or at least resisteth the waters , so that they should not altogether ouerwhelme the Land : But this reason is altogether deficient in Nature : Because *Drouth* and *Moisture* are no such qualities to haue such an operation : and if any such there were betwixt *Drouth* and *Moisture* , the *Drouth* (as wee see by experience) would rather draw moisture vnto it , then any way expell it , or driue it away : whence it is most euident , that it was effected by no other meanes then the immediate worke and prouidence of God , for the preservation of liuing creatures : for , before God said , *Let the waters bee gathered into one place* : the Water was said to couer the whole face of the Earth ; but afterwards at Gods appointment , the water went backe , and shewed the dry-land . But by what meanes God separated the one from the other , it is much controuerfed amongst *Diuines* and *Philosophers* . Many were of opinion , that the Earth was suffered to stand intire without alteration , and that the waters

were eleuated aboue it; so that if they were suffered to flow abroad, they might againe couer the face of the Earth, as in the beginning.

But why the Waters should bee thus restrained, is not agreed among them: for some thought, that this was done by the miraculous power of God, which restraines the flowing abroad of the Water, beyond ordinary bounds; of which opinion is *St Ieremie*, who grounded his opinion (as it seemes) on the authority of the Scripture, especially in the 8 of the *Proverbs*, and the 103 *Psalme*; where God is said to haue set a bound vpon the seas, which they should not passe: But this reason seemes not warrantable; That the great Creator of all things, should in the first institution of *Nature* impose a perpetuall violence vpon Nature. Moreouer all miracles are temporary, and not perpetuall; for then were it ordinary, and so scarce a miracle: others vpon lesse ground, haue imagined that there are certaine *Northerne* starres in *Ursa maior* and *Draco*, of so great vertue, that they can draw the Ocean from this habitable part of the earth toward the *North*, and so constrain the waters, that they cannot ouerwhelme the earth: but this opinion is ridiculous, and deserues no solide refutation: being a meere coniecture, without ground or probability: others vpon the like reason, haue dreamed that there is more *Water* then *Earth* in the Globe; and that the water by his extraordinary masse occupying the center of the world, turnes the earth on one side, making it to swimme as a ship vpon the sea: But this assertion wee haue refuted in our first *Chapter* of the first booke: All these Authors suppose that the earth is vnconquered toward the North-Pole; but ouerslowne with waters towards the South: which the experience of Nauiगतours at this day hath sufficiently disanulled: Others againe affirming out of a *Peripateticall* dreame that the water is ten times greater then the earth, suppose the earth to bee like a sponge to drinke vp the water: to proue which assertion they produce an experiment, that the earth being digged any thing deepe in most places, there will appeare water: whence they collect that the water is mixt
with

with the whole earth, and receiued into it's concavities : But howsoever wee may graunt, that there are many and vast concavities in the Earth, capable of Waters; yet it is impossible, that the Water should bee ten times as great as the Earth : for by this reason, although all the Terrestriall Globe were Water, it could not bee, but that a greater portion of Water, then that in the Earth, should arise aboue the Earth : because, according to their owne *Supposition*, 9 partes should bee aboue the Earth : Neither can *Aristotles* words bee well wrested to this interpretation : For as much as hee vnderstood this ten-fold proportion of the Water to the Earth; not of the *spaces*, which they replenished, measured by their *Circles* and *Diameters* : but of the proportion they beare one to the other in their transmutation : as that one measure of Earth turned into Water, should bee as much as 10. All these opinions seeming so absurd, it seemeth more probable to imagine, that either the Waters are *condensated*, and thickned, which were in the beginning created thinne : whence will follow, that they should occupy a lesse place, and by consequence, leaue the dry-land in many places habitable : or, which is more probable; that God in the first Creation made certaine hollow concavities and channels in the Earth, which was before plaine and vniforme; into which the waters were receiued and bounded, in so much, that they could not flow abroad. This seemes enough to satisfy the search of such as are not too curious to search into his secrets, whose power and omnipotence transcends the capacity of the wisest : In this diuision of a place into *Water*, and *Land*, wee will first treat of the Sea, and the accidents belonging thereunto; Not that the water is worthier or greater then the Earth; The contrary whereof wee haue proued heretofore : but because the consideration of it, is more simple, as that wherein fewer matters are to bee handled then in the land. For Riuers and Lakes, although consisting of this watery element, wee thought fit to handle apart : as adiuncts belonging to the land.

4 In the Sea are considered two things : 1 The

E c 3

Adiuncts,

Adiuncts, 2. *The Diuision*. The Accidents of the sea whereof we are to treat, are either *Internall*, or *Externall*.

5 The *Internall*, are such as are *inbꝛed* in the Sea: These againe are either *Absolute* or *Relative*.

6 The *Absolute*, are such as agree to the Sea, without any comparifon with the land: such are either *Figure*, *Quality*, or *Motion*.

7 The *figure* is the conformity of the externall superficies of the Sea; whereof obserue this *Theoreme*.

1 *Although the whole body of the water be Sphericall, yet it is probable that the parts of it, incline to a Conicall figure.*

That the whole Water according to it's outward superficies, is *Sphericall* and *round*, is sufficiently demonstrated before, in the first booke. But notwithstanding this roundnesse of the whole, the parts of it may (for ought I see) admit of a *Conicall* figure; for as much as this hath little or no proportion to the vast *Sphericity* of the *Water*, no more then little hills, to the greatnesse of the *Earth*. For the prosecution of which point, I will first shew the reason of this my coniecture, grounded on experience; and afterwards out of the ground and demonstration of the principles of *Mathematicall Philosophie*, endeavour to make it more manifest. First therefore by a *Conicall* line, wee vnderstand a crooked line which differs from a *Periphery* or circle, in as much as it keeps not alwayes an equall distance, from the center: but is higher in the midst, then on either side: Now if the parts of the water standing still, were in

in their higher superficies exactly sphericall; they should by the same grounds bee *concentricall*, or have the same center with the whole Earth. But that it hath not the same center, will appeare by little *dropps* of Water falling on the ground, which incline (as wee see) to a round figure; yet were it more then ridiculous to say, that this round convexity of a droppe could bee *concentricall* with the whole Earth: sith in so great a masse, it is hardly sensible. But here our ordinary Philosophers are ready to answer, that this conformity of the water dropps in a round figure, is rather *Violent*, then *Naturall*: because the Water being by nature moist, is ready to fly, and avoid the touch or drouth, or any dry thing. And because the Water thus avoiding the drouth, cannot of necessity but some way touch it, it is imagined to conforme it selfe to that figure, whereit it may least of all touch: This is the round or *Sphericall* figure; wherein any body contained, cannot touch a *plaine*, other wise then in one onely point. But against this conjecture of moisture flying *drouth*, strong enough is the experiment of *Scaliger*, in his 105. *exercitation*: that *quick-silver* a moist substance, being cast either into *Water* or *Iron-Oare*, will gather it selfe to a round body, notwithstanding it is manifest, that *quick-silver* naturally neither avoids the touch of *Water* or *Iron*, for as much as the one is very moist, the other of great affinity, (as our *Chimicks* teach) with *quick-silver*, the parent of all Metals. Moreover it is manifest, that this conformity to roundnesse, is in dropps of raine falling to the Earth, through the *Aire*: yet will not our *Peripateticks* admit of any drouth in the *Aire*, which this moist element should seeke to avoid. Moreover if Water should conforme it selfe to roundnesse, by reason of the drouth of the body, whereon it fall, then must it follow; that either the moisture of the *Water* should expell the drouth of the *Earth*; or else that the drouth of the *Earth* should worke on the moisture of the *Water*; But neither can be graunted with probability. First because moisture and drouth are not qualities of such activity to drive and remove, one the other from one place to another, as it is here imagined: Secondly, if the moist should worke on the

dry, it should either touch it or not: If it touches not, it can not worke on it: because no *Physicall* action can bee performed without touching: besides, it were very impossible, to imagine that without this touch, one of these qualities should perocine or tent the other to auoid it. If it touch, it auoides not the touch, but ioynes it selfe with the drouth: And indeed reason and experience shewes, that drouth rather couets and drawes vnto it selfe moisture, then expels it: wherefore *Scaliger* goes about to forge a new cause of this experience. Every thing (saith hee) in this nature is one, and the selfe-same: But this vniuity in Homogeneall bodies, is best preserved in a *Globe* or *round figure*: wherein is no inequality, no parts higher or lower, abounding or deficient. But here might a man aske why the greater parts of the Water are not likewise conformed vnto roundnesse, as well as the lesser droppe; Hee would perhaps answer, that nature in them was not in such distress, to make vse of this speciall priuiledge; I grant it: yet find I in this no satisfaction; for as much as hee giues a final cause, where I sought an efficient: for I would farther aske by what action or motion this water should gather it selfe into a circular figure, and from what forme it should arise: for first wee haue shewed, that this motion cannot proceed from the externall drouth, wee must seeke the cause in the water it selfe: here wee shall finde it, either the *particular* forme of the water, or a certaine *vniversal* forme, as some suppose it cannot bee imagined, that it should proceed from the generall forme of the vniuerse: First, because as wee haue elsewhere proued, there is no such Internall forme of the world: Secondly, those motions are commonly ascribed to an *vniversal* Nature or forme, wherein any particular body (as it were) neglects his owne Nature, for the preservation of the whole Vniuerse. But here water containing it selfe in an orbe, and not flowing abroad towards the Center, rather seemes to forsake the Center and Vniuerse to preserve it selfe. Whence we must necessarily conclude, that this roundnesse in drops of water cast on the sand, proceedes not from externall drouth, nor any vniversal forme, but from the speciall and essentiall forme of the

the water ; and consequently , because it makes a circle *excentricall* with the Earth , it must bee found rising higher in the midst : To which wee will adde another experiment : Let there bee cast on a large Table or planke , a little portion or drop of water : I here aske , whither this water on the midst of the Table equilibrated , will continually flow abroad , or at length suffer a stay or stop ? It cannot bee continually spread abroad : first , because experience teacheth the contrary ; for we see little drops cast on such a plaine , to confine themselves within certaine bounds : and least any should imagine (as before) that this happens by reason of the drouth of the Table , let him first moisten the Table , and hee shall find no great alteration : Secondly , if the water should alwayes fall downward , and so still runne abroad , and spread it selfe to the margents of the Table , it would follow , that if the Table were of an infinite capacity , the water thus shed , would infinitely flow abroad , without intermission ; and so should Nature set no bound to the thicknesse and motion of the water : whereof experience hath sufficiently taught the contrary . Now , that water thus standing (still on a plaine equilibrated Table , should have a *Canonick* figure , it may bee plainly proved almost by sense , whereby wee perceive the middle to bee higher then the extreames : for no man can deny but the water thus standing , is endowed with thicknesse , for as much as it is a naturall body . Wherefore of necessity it must swell above the Table . It cannot bee *Spherically Concentricall* with the whole Earth , because in so small a segment of an Arch , as this little quantity of water admits , it would bee insensible . It cannot bee plaine , because the sides or extremities of it touch the Table , whereas the middle *superficies* , by reason of the thicknesse , is elevated above the Table . Neither can wee imagine another figure besides , which can aptly bee admitted . It is meet in the next place , that out of the grounds of Philosophie , wee explaine how it comes to participate this figure : where wee are first to vnderstand , that the figure of the water is (as it were) compounded of two spheres ; whereof the first is imagined to bee *concentricall* with the whole Earth ; the other lesser onely answering to the portion

or quantity of water, were it made round; for if wee consider the simple and particular nature of the water, wee shall find it inclining to roundnesse of it selfe, as wee haue shewed by experiment; yet such a sensible roundnesse, as cannot haue one *Center* with the Earth. But if we consider the water as it concurreth to the constitution of the whole Vniuerse, wee shall find this Figure to partake of a *circular segment concentricke* with the whole Earth. Now because neither of these two Figures can precisely and exactly arise by it selfe, sith the one must needs somewhat alter the other, wee must of necessity admit of a figure mixt and compounded of both these; which can bee no other then a *Cone*. To expresse this more plainly (because this path is yet vntroden) wee find in the water a double motion directed to this double figuration. The first whereof is that, whereby all the parts of a quantity of water, are inclined to an Absolute roundnesse, or Sphericall Figure, without respect of the Vniuerse: the Center of which roundnesse, is to bee sought in the water it selfe. The later is that, whereby the parts of the Water conforming themselues to the Center of the Earth, as neere as they can, make a *Sphericall figure* (as much as Nature can suffer) *concentricke* with the whole Terrestriall Globe. In the former of these motions, the Water seekes it's owne preservation; in the later, the safety of the whole Vniuerse: for the safety and consistency of the whole, is deriued from the part, which concurre to preserve the whole. To expresse a little better the manner of these two concurrent operations; we will take for an vndoubted ground, *That God hath given to Nature a power and inclination to preserve herselfe*. This granted, wee must distinguish of a two-fold preservation: the one *Speciall*, wherein euery Body seekes it's owne safety: the other *Generall*, wherein all Bodies concurre to the preservation of the whole: The former proceeds from the speciall Forme and Nature of euery Body; which is performed by the vnion of all his parts to it selfe; this vnion is greatest of all in a Sphericall figure; wherein all the extreme parts are equally distant from the Center, admitting no Equality of dimension. The Generall depends from this Resultancy and

Har-

Harmony of all the parts, whereby is caused an vnion of all the parts with the whole; to whose preservation they are secondarily directed: whence ariseth a double figurature of the water; the one of a Spheare, excentricall with the Earth: the other also of a Spheare, but concentricke with the Earth; whereof this Conicall figure is compounded. Why this figure should be more sensible in a small drop or quantity, then in the Ocean, may bee declared from the same ground well vnderstood; becaute the conuexity of the lesser Spheare excentricke with the Earth, is more; and the greater, is lesse: for by how much the lesser is the Spheare, the greater will be the conuexity: and by how much greater the Spheare, the lesser will the bee conuexity, or crookednesse. Wherefore this crookednesse being in a small measure of water very sensible, in a maine Ocean will by sense be hardly distinguished from a right line.

8 Of the Figure of the Water wee haue spoken: Wee must now speake of the Quality, which is two-fold: Saltnesse, and Thicknesse.

1 *The Water of the Sea is salt, not by Nature, but by Accident.*

That the Sea is of a saltish Quality, no man hath euer doubted, at least in most parts: But whether this saltish Quality, essentially agrees to the center of the Sea, as therein created, or else Accidentally brought in, I finde no small difference among Philosophers. Those which defend the saltishnesse to bee Accidentall, are diuided into diuers sorts: for some of the old Philosophers imagined, that the Earth chafed and Heat with the Sunne, continually sweats out water: whence is made the Sea, and therefore should haue a saltish taste, because all sweat is of this Quality: But this opinion I take to bee no other then a pleasant Allegory of the old *Greeke* writers, who wrote their Philosophy in verse, and therefore vsed such allusions, as wee shall perhaps find in many other matters, poetically deuised
of

of them ; yet refuted of *Aristotle* in good earnest : others have more probably coniectur'd, that this saltishnesse was first deriued from the Earth , through whose parts the Water being strained, is apt to receiue this Quality, being primarily in the Earth it selfe : as wee see water being wrung through ashes, to grow salt : but this opinion seemeth of no great soundnesse ; because the first Riuers and Lakes being drawne out of the Earth altogether , and in regard of their small quantity , more apt to yeeld and receiue this tincture , are notwithstanding deuoid of all such Quality. Besides this , wee rather find the contrary by experiment : That Sea-Water strained through clay , will turne fresh : as likewise powdred flesh being layed to soake in salt water , will soone turne sweet : The former is verified by *Baptista Porta* : of the other , euery kitchen-maide on the Sea-side will informe vs. The third opinion is of *Aristotle*, who referres the saltish quality of the Sea-water to the *Sunne*, as the chiefe cause , drawing and lifting vp out of the Sea store of exhalations , which afterwards mixt with vapours , fall downe againe by drops : for the *Sunne* drawes vp the thinner and fresher parts of the water , leauing the thicker and lower water to suffer aduision of the *Sunne*-beames , and so consequently to become salt : so that the matter of this saltishnesse in the Sea , is by an exhalation : the *Sunne* drawing vp to the middle Region of the Aire, the fresher parts ; where thickned , they descend in raine , leauing the residue of the Sea salt. The forme is the straining and concoction, which is made by the *Sun* ; for the saltishnes is said to arise out of the commixtion of Terrestrial drynesse , concurring with moisture , ioind with aduision of Heat : so that two things are chiefly concurring to the Generation of saltishnesse ; to wit, Dronth and Aduision. This seemes to bee prooued by instance of Fresh-waters in the kitchen, which turne salt, being much boyled , because the thinner and sweeter vapours of it are drawne vp , and dissipated, leauing that behind which is thicker and saltish. The same would some haue in the Sea, seethed (as it were) and burnt with the Heate , which we experimentally find in hot water on the fire. But this is excepted against by some , because wee find by experience ,
that

that many salt wells and fountaines arise in diuers places of the Earth, which are ingendred in the bowels of the Earth farre remote and separate from this extreame heate and aduotion of the Sunne-beames: But to this wee may easily answer, that such salt springs are either by some violence enforced from the sea by certaine secret cauernes, and hollow places of the Earth: or else that they receiue their tincture of saltnesse from some salt minerals of the Earth, through which they passe. Wherefore this opinion of *Aristotle* I see not yet sufficiently refuted. The other opinion concerning this quality of such, which would haue it essentiall to the sea water, and inbred in the first creation, is grounded on two finall causes: First they say that the sea is salt, for the preservation of the Fishes, who would otherwise rot, because experience shewes, that Fish will soone putrifie without salt; but this is thwarted by three reasons: First, because if fish were in this sort salted in the sea Water, the cooke might saue himselfe a labour in salting them againe in his kitchen: Also Fishes caught in the sea, are oftentimes preserved longer and sweeter, lesse needing salt then those which are found in fresh Ponds and Riues: Secondly, if this reason should hold currant, why should not the Fishes also rot and putrify in fresh Water? Thirdly, why should fishes couet the fresh Water (as wee see by experience in many fishes) if in it they should suffer putrefaction, which is a great enemy to nature; Aboue all what need wee feare this putrefaction of fishes, while they are endowed with a liuing soule, which is a greater preseruatiue then all the salt in the world; or why should wee not doubt the same calamity in all liuing creatures in the land, which are as subiect to rottenesse in the Aire, as the other on the land? The second cause (say they) Why the sea should bee created salt, is; Because the sea it selfe should not putrify, for as much as wee find by experience, that salt is the only thing to resist Putrefaction; But here wee may demand; why these Authors should feare Putrefaction in the vast body of the sea, rather then in other Waters and Riues, which are neither salt, nor come neere the greatnesse of the Ocean;

whereas

whereas *Aristotle* affirms in the fift chapter of the 4 booke of his *Meteors*, that if the Sea were diuided into many parts, it would more easily dissolve and putrify. The grounds of this opinion being ouerthrowne, there want not reasons to contradict: First (sayes one) if the Sea were not created salt, then was there some time wherein it was fresh: To this I answer two wayes: First, that it might bee created fresh, yet being apt from the heat of the Sunne to receiue saltnesse, it might, almost at the first receiue it. Secondly, if I should grant that it was a long time before it embraced this quality, I know neither History to confute mee, or reason to conuince mee. Secondly, it is vrged from the Nature of lining creatures in the Sea, that they cannot well liue in fresh waters, and therefore it seemes originally salt, and not by Accident: But this is of no great force: First, because experience shewes, that many kind of fishes liue in both, and many rather couet and desire the fresh Water, then the Sea: Secondly, it is not improbable, that as the Sea by little and little and by degrees turned from freshnesse to saltnesse, the temper and disposition of the fishes, was in like manner changed and altered: Whence it may come to passe, that fishes since bred and nourished in fresh Waters, cannot so well endure the salt. Moreouer who knowes whether all these scuerall kinds of fishes now found in the Sea, were from the beginning, since wee see by experience, that sundry kinds of lining creatures dayly arise out of putrefaction on the land, which may with like probability, or more, bee admitted in the Sea. There are yet behind other reasons of one *Patricius* a *Platonist*, who would oppose *Aristotle* in good earnest. *Aristotle* (saith hee) speaking of the saltnesse of the Sea Water, shewed not the cause. For I would aske, why that parcell of water, from whence the thinner parts are extracted, should remaine salt: was it so from the beginning, or afterwards imprest; was it *Inbred*, or *Accidental*? If hee would haue it an inbred quality from the beginning, hee vainly goes about to seeke out the cause; If the saltnesse bee *aduentitious*, the cause is to bee giuen; but the cause giuen by him, is not true, for as much as it rather takes away the saltnesse. But to these

these obiections of *Patricius*, spunne out in many words, wee may answer two wayes: either that the saltnesse is meere aduentitious bred by an exhalation, drawne vp by the Sunne, and so distilling downe againe; or else, because this answer seemes not wholly to satisfy. For as much as rainy Water is seldome salt, and if it were, could hardly flow in so great quantity to feed the saltnesse of the Sea: I will answer secondly, that the saltnesse is radically or originally in the matter of the Water; yet so, as it cannot bee drawne out and sensibly bee perceiued in the mixture of many sweet humours, ioyned with it, without a separation first made by the heat of the Sunne of the thinner parts from the thicker: So that the Sunne is a disponent, though not a productiue cause of this saltnesse in the Sea.

2 *Seas absolutely salt, are neuer frozen.*

This may seeme a *Paradoxe* to some men, in regard that amongst our *Geographers*, wee haue so often mention made of *Mare Congelatum*, taking it's name from the Ice wherewith it is shut vp from passage: as also for that in the voyages of *Frobisher*, *Davis*, *Hudson*, and other later Nauigatours, which haue beene employed in the search of the *Northwest* passage, wee find such strange relations, not onely of Seas closed vp with Ice, and hindring their passage towards the North; but also of *Rocks* and *Ilands* of Ice, of an incredible greatnesse. The truth of these Relations I no way disapprove, but rather out of these testimonies, approve our former assertion; that Seas which are wholly *Salt*, are neuer found to freeze: For first whereas it is called *Mare Congelatum*, it may beare the name well enough from the multitude of Ice floating on the water, or collected into a *Rocke* or *Iland*. This Ice (as it will easily appeare) is not produced out of the substance of the *Salt* water of the maine Ocean, but rather carryed into the Sea by great riuers of fresh water running into the Ocean: For the riuers are not alwayes frozen; but sometimes by a remission of the cold are thawed, and the peeces broken a sunder, and floating into the Sea, in it oft times meet in great heapes, which may be proued: 1 In that these great rocks of Ice melting with the heate

heate of the Sunne, haue dissolued into fountaines of fresh water, gushing downe in great abundance, wherewith sometimes in case of necessity, they haue fraughted their shippes, as wee haue testified by the fore-named Nauigatours. 2 Because some part of the same Sea; situate perhaps more Northerne, and in a colder Climate, suffers not this accident: whereas places neere the shore, farther South; are almost alwayes frozen: The reason whereof, is; because the Sea neere the shore is commonly mixed with fresh waters, conueyed in, either by great Ri- uers, or infinite secret passages vnder ground, which wee see not: The reason why that salt waters exclude this propriety incident of the fresh, I take to bee the *Hot-spirits*, hid in the salt humor, which are more feruent and operative, then those of the fresh water.

9 So much for the *saltnesse*: The next, is the *Thicknesse*: whereof we will set downe this *short Theoreme*.

1 *The Water of the Sea is thicker then other Water.*

This Proposition hath it's light from the former: because thicknesse of Water is a companion of the saltnesse, as depending from the same cause, to wit, the exhalation, and extraction of the thinner parts of the Water. There are many small causes giuen by *Parricius* of this thicknesse of the Sea-Water. First, because the parts of it should more strongly hold together, and not couer and ouerflow the firme land: But this seemes to bee grounded on an error, that the Water should be aboue the Land; and that it should containe it selfe within it's owne bounds and limits, which opinion we haue elsewhere reiected. The second cause of the thicknesse of the Sea, is; that it might bee more apt to beare and carry ships, and other great weights for the vse of man. Thirdly, the Water being thicke, may more easily bee conuerted into *salt*, out of which, many saltish minerals in the Earth are ingendred. Other causes are giuen

giuen by this Author, but lesse forceable, which we will omit, as referring them to the Philosopher, whose proper taske it is to seek them out.

C H A P. VI.

Of the Motions of the Sea.

1 **T**He Motion of the Sea, whereof we are in this Chapter to treat, is either *Naturall*, or *Violent*. The *Naturall* I call that, which is partly incident to the *Naturall* Disposition of the Sea.

2 This againe is two-fold, either *Generall*, or *Speciall*: *Generall* is that which agrees generally to all, or at least to most parts of the Sea: such as is the *Ebbing* and *Flowing* of the Sea.

Wee must here obserue, that the Water hath a two-fold Motion; The first is common to all heavy Bodyes, as well as the Earth, in which is an inclination to come as neere as they can to the Center of the Earth, whereof wee haue spoken in our former booke: The second is that which more properly agrees to the Sea, which is againe twofold: either the *Naturall*, or the *Violent*. The *Naturall*, howsoeuer requiring perhaps the concurrence of some externall cause, is notwithstanding so called; for as much as it chiefly seemes to proceede from the Disposition of the Sea-water; The *Violent* is caused meere by the violence of the winds mouing the Ocean. The

Naturall motion we haue againe diuided into generall, or speciall; because the *Afflux* and *Reflux* of the Sea, whereof we are to treat, is generall throughout the whole Ocean, (some petty creekes perchance excepted) whereas the Currents, (which is the second kinde of motion) are more speciall, as agreeing not to all, or most parts (as it seemes) but to some one or other speciall place, as we shall shew.

1 *The Sea twice euery day ebbes and flowes.*

The flowing and ebbing of the Sea, howsoeuer it cannot be precisely obserued in all Seas; yet because few places of the maine Ocean are exempted from it, deserves the first & chiefest consideration. That such a motion there is, experience shewes; but the searching out of the cause, is, for ought I can obserue, one of the greatest difficulties in all *Naturall Philosophie*: in so much as *Aristotle* one of the acutest Philosophers, is reported to haue stood amazed at the flowing and ebbing of *Enripus*, and despairing of finding out the cause, at length enforced to cast himselfe into the Riuer which had before confounded him. Wherefore it may seeme sufficient for mee to trace their steps, who haue waded far into the search of this cause, hauing very little hope to goe further. The first opinion was of the *Stoicks*, who supposed the whole World to bee a great liuing creature, composed of diuerse Elements, which inioyes both breath and life: This liuing creature they imagine to haue his nostrils placed in the maine Ocean, where by drawing in, and sending forth breath, the *ebbing* and *flowing* of the Sea is caused: but this seemeth rather to bee a *Poeticall* fiction, or *Allegory* then any conceit of a Philosopher. *Apollonius Tiansus* was of an opinion, that certaine Spirits either vnder, or aboue the Water, breathed into it this motion. *Timaeus* taught the cause of this moisture to be the riuer, breaking into the Ocean by the great mountaines; *Plato* thought that it was made by the swallowing vp of the Sea into a gulfe or hole which being againe cast out, was the cause of that motion in the Sea. *Selenus* the Mathematician, which affirmed that the Earth was carried round with a perpetuall motion, thought

thought that the Moone was turned round with a motion contrary to the motion of the Earth, and from this to proceed that motion of ebbing and flowing of the Sea, whereof we now treat. What *Aristotles* opinion was concerning this matter, is an vncertaine coniecture; forasmuch as little or nothing can bee gathered touching this point in controuersie out of any booke, which is certainly knowne to be *Aristotles*: for the tract of the propriety of Elements, where the cause of this motion is ascribed to the *Moone*, is iudged to be none of *Aristotles*, but of some later Authour. Yet *Plutarch* imposeth on *Aristotle* this opinion; that this motion of the Sea should come from the Sun, because by it are raised vp many windy exhalations, which should cause the Sea to swell, blowing into the great Atlantick Ocean. But this opinion is charged by *Patricius* of a threefold error: 1. That it should proceed from the Sun; 2. From the wind; 3. That it is only in the *Atlantick* Sea. He saw (saith *Patricius*) that in the *Atlantick*, which he could not in the *Egean* Sea at home and neere *Athens*. For 1. No wind blowes so regularly, that for one six houres it should blow forward, the other six houres backward: for the wind oftentimes blowes many daies the same way without ceasing; yet is their not one only flowing or one ebbing in the Sea. 2. The *Sunne* stirres vp sometimes windes, and sometimes stirres them not vp. But of a *perpetuall* effect which is daily, why would this Philosopher giue a cause meereley *violent*, and not *quotidian*, which notwithstanding would haue nothing violent to be perpetuall? If the Sea bee somewhere moued naturally by other motions, as the *Euripus*; (which is said to be his death) wherefore will he deny this motion to be *Naturall*, seeking out an externall cause of this effect? But all this while our *Platonick* Philosopher seems to fight with shadowes: for what iudicious man can imagine so iudicious and wise a Philosopher as *Aristotle*, should so grossely overshoot himsele to father this opinion? I should much rather beleue that no such opinion is to be found in *Aristotle*; at least that it is indirectly related: which I the rather beleue, because one *Casalpini* a late Writer, aswell opposite to *Aristotle*, as the

other hath related *Aristotles* opinion otherwise; to wit, that the ebbing and flowing of the Sea is deriued from a double cause: whereof the one is the multitude of Rivers bringing in a great force of waters into it: whence it comes to passe that it flowes onely towards one part, which is the lower, as it happens to the *Mediterranean*; For the *Egean* and *Pomick* Sea, with *Meotis*, flow into the *Tyrrhene*, and not on the opposite side: The other cause hee makes to bee the *libration* of the whole Sea: for it is often turn'd from one side to the other, which in so great a vastnes seemes but little; but in straights & narrow places much more. So that *Aristotle* (saith *Casalpinus*) would haue that to agree to the Sea, which vsually happens to a paire of ballance: which hauing receiued the beginning once of their motion, are inclined sometimes this way, & sometimes that way, by reason of the equality of the weight: for if the weight of one should ouercome, the whole would incline that way, and would not rise vpon the other side. But against this opinion imposed on *Aristotle*, *Casalpinus* notwithstanding good reason, excepts, that the *Superficies* of the Water being *Equidistant* from the Center (as is supposed by *Geographers*) no reason may bee giuen why it should incline more to one side then another, hauing once obtained his true place: sith according to *Aristotles* owne grounds, no violence can be perpetuall. To which I may adde another answer, that no satisfactory reason can be alleadged, why it should alwayes obserue so true and iust periods of time in its motion: sith all Rivers are sometimes encreased, and other times diminished according to the season of the yeere, and variety of the weather: wherefore the said Authour, which impugneth this opinion, hath framed another conceit, grounded on the circular motion of the Earth, which he explaineth in this sort. It agrees to reason (saith he) that the Water should not altogether follow the motion of the Earth, but should in part bee driuen backe, and in part flow besides: for since it is of a moist nature, while the Earth is carried from the Aire about it, the Water is somewhat left behind; as wee may see in a small vessell, which is more large then deepe: for if it be moued forward, the
 Water

Water will leape back to the opposite part, & will oftentimes poize it selfe hither & thither, seeking an aquilibration: when therefore the Earth is a litle caried forward, & the water (as it were) left behind; being out of his *Equilibrium*, or a quall poize, it will runne to the other part, but beyond the true poize; for the violence of the motion oppressed into it in the beginning, from thence, for the same cause, it will tend againe to the opposite part, doing this oftentimes, seeking an equall weight, wherein it may rest: so that if the Earth should at any times rest from her naturall motion, the Water would also leaue off the *Libration* to and fro. But because the circumvolution of the Earth is imagined to be perpetuall, the libration of the sea is also perpetuall: so farre forth then that this motion is of the continent or Earth, it is onely accidentall in the Water, neither besides his proper nature, neither according to nature: But so farre forth as the Water is in some sort moued in the Earth, it may be said to be according to nature: for it alwaies seekes the lower place, because it cannot aqually follow the motion of the Earth. Hence they giue the reason, why this motion is not perceined in Lakes and Rivers, as well as in the maine Ocean: for sith the motion of the Earth is not very sensible, it cannot be perceined but in a great masse of waters. The reasons to confirme this opinion, besides the refutation of other opinions, are chiefly these two. If the Water by it selfe should be mou'd without the motion of the Earth, it must needs be moued either *according to*, or *against* his nature. But neither of them can be graunted; First, if according to Nature, there would not be one only motion of one body according to nature, but many, which is denyed by *Aristotle*; If besides, or against Nature, some violent motion would bee perpetuall, which also seemes absurd: wherefore it must needs follow, that the sea should moue accidentally: For sith the Water is contained outwardly of the Aire, internally of the Earth: And that part of the Aire which toucheth the Water is of *Aristotle* called *Stagnans* or standing still, not flowing, as that which is aboue the Earth, but is onely troubled variously with windes. This libration or motion of the Water

cannot be caused by the wind or Aire, wherefore it must proceed from the motion of the Earth. The second reason may be drawne from the quantity of tides in diuers places of the Earth, for it is found by experience, that the Water swells higher & greater in the *maine Ocean*, then in other *lesser Seas*. For it is obserued, that about great *Brittaine*, it mounts sometimes aboue 80 cubits: also it oftner ebbs and flowes in lesser currents, because the spaces of this libration are shorter and straighter: or because besides the motion of ebbing and flowing, which the *Mediterranean* seas partake from the *Ocean*, at *Hercules Pillars*, they haue a proper libration in their owne channels: whence it comes to passe that in some narrow seas, as in the *Euripus*, besides *Euboea*, the sea leauen times a day ebbs and flowes: whereof there can no sufficient reason be giuen from the motion of the *Moone* or other cause whereto other Philosophers ascribe this effect: This opinion of *Casalius* seemes to carry great likelihood of reason and congruity with experience: yet because it is grounded on the circular motion of the Earth, which seemes a paradox to most men, I dare not warrant it otherwise then probable, neither can it well stand with the grounds of our *Magneticall* Philosophers, because they affirme the whole spheare of the Earth and Water together with the Aire to moue round with one *Vniforme revolution*, in such sort as one should not moue to the opposite part, or stay behind the other; as they would haue it here to doe. There is yet another opinion more commonly defended in the schooles of naturall Philosophers; that this motion of the sea is to be ascribed to the *Moone*, as the principall cause: others againe, as they admit the *Moone* to haue her operation in this effect, ioyne other causes to it: and indeed this seemes more probable: for there want not arguments in *Patricius* and other later writers, to shew that the *Moone* cannot be the sole cause of this motion: First, because this motion is not obserued in all seas, Lakes, and Riuers, whereupon neuerthelesse the *Moone* hath the like dominion: But experience shewes the contrary: for besides fresh Riuers it is manifest by obseruation of traualers, that this ebbing and
flowing

flowing is not to be found in the *Hircan*, *Mantian* and *Dead* sea, also in *Maotis Palus* in the *Pontick*: *Proponticke*, *Ligurian* and *Narbon* streytes, neither in the *Tyrrhene* sea: Moreover it is not obserued in a great part of the *Red* sea: Neither can the *Narrownesse* of the channell excuse it, because these seas are great, and also for the most part within the *Tropicke* of *Cancer*, and therefore exposed sometimes to the perpendicular beames of the *Moone*. Secondly: If the *Moone* should by her owne force excite and moue these waters, then would it moue those seas, which it doth moue, *Altogether* and not only in *parts*. The contrary whereof we may find: First in the *Red* Sea, which in the beginning and end, *Ebbes* and *flowes*, but in the middle not at all: moreover the *Mediterranean* sea ebbes & flowes as one sea, on all the coasts of *Africa*, wherein it is in a sort diuided; and yet those seas, with which it is ioyned, as the *Tyrrhene*, *Ligurian*, and *Gallican* Seas, feele not any such motion. Thirdly; it is objected, that if the *Moone* were the only cause of this *Flux* and *Reflux* of the sea, then those seas, which are said in whole to moue, should equally flow in hight: but this is contradicted by experience: because some flow higher, and some lower. As for example: The *Adriatick* sea in the inmost creeke neere *Venice* swells neere foure foote in hight; but the rest of it, not about two foote: which increase is likewise obserued in the *Egean*, *Cretian*, *Ionian*, and *Cyprian* Seas; also the *Syrian* and *Egyptian*, euen to *Portus Ferina*: But from *mons pulcher* to the *Herculean* streytes, it increaseth about two foot in length: But without these straights, the same Ocean by the coasts of *Portugall* and *Biscay*, and *France*, the Sea riseth vsually to 15 foot in hight; and neere the coasts of *Belgia* and *Brittaine* 18 foot: At the confines of *Bristoll* to 60, and thence to the borders of *S. Michael* to 60: But at the coasts of *Ethiopia*, neere the *Atlantick* shores; it riseth not higher then in the *Adriatick* Sea: But neere the Islands of *Madera*, the *Canaries*, and *S. Thomas*, it surpasseth not the hight of *Venice*: But in *America*, on the hithermost coast from *Florida Sinus Mexicanus*, the coasts of *Brasile* and *Paria*, more then three thousand leagues, euen to

the *Magellane* straights it increaseth almost to two Palmes breadth: but farther South to *Panama*; and all those Southerne shores, the ebbing and flowing is of an excessive hight, as may appcare by the coasts of *Cambaia*, *India*; and *Taprobana*: Thirdly, if the Moone by a naturall vertue should moue the Waters of the Sea, then wou'd it moue the *Ocean* and the *Mediterranean* Seas in the course of windes, with the same Fluxe and Reflux in the same windes. But this thwarts experience, which is thus proued: The *Mediterranean* Sea, when as it flows in the *Adriaticke*, *Ionian*, and *Sycilian* Seas, the Water flows towards the Land, when the Moone is (as the Marriners speake) in *Sirocco* and in *Maestro*; but ebbes or flows backe from the Land, when it is in *Graco* at *q*, *Garbinio*: And contrariwise the Ocean swells when the Moone is in *Graco* and *Garbinio*; but aswageth it selfe againe when it is carried in *Sirocco* and *Maestro*. Fourthly, if the ebbing and flowing of the Sea should follow the Moone, then all places in the same distance should ebbe & flow alike at like houres. But the contrary is proued by an experiment of *Patricius*, who reports, that at the same houre places distant 20 degrees, haue bin seen to ebbe or flow alike, and the places betwixt also to vary and obserue no iust proportion. Fourthly, if these Surges should be stirred vp by the Moone, then the same *superfoies* of the Water the same houre should bee carried by the Moone: but this is contrary to the obseruations of Marriners; who haue obserued, that on the *Norman* coasts, and that of *Picardy* to *Callice*, the Tide happeneth the ninth houre from Midnight: but ten miles from the shore not a full houre, but at the twenty and sixt mile from the middle of the channell, and vnder the same Meridian at 22 houres. Fifthly, if the ebbing and flowing should proceed from the Moone, then should the Water at the same houres increase and decrease: but this is opposite to obseruation: for at *Venice* the Sea is knowne to flow sometimes for seuen, sometimes for eight; but ebbes in fewer houres, But about the mouth of the River *Senega* in the *Atlanticke*, it is comming in foure houres, but goes not backe vnder eight: so about *Consumia Ofla*, the Tide is comming

in.

in seven houres, but goes backe in five. Sixtly, if the Waters flow by the Moone, then should they bee drawne and carried by the light of the Moone: because all action is by a touching, and the Moone toucheth the Water by her light: but it is found by experience, that at midnight, when the Moone is most distant in her light, our seas doe no lesse ebbe and flow then when it is present: & so the Seas neere the *Antipodes* doe ebbe & flow, when the Moone is present with vs. 7^{ly}, if the Moone were the onely ancient cause of this motion, then the same light being present the same age^t moving, the same effect should necessarily follow. But we find that it produceth two contrary one to the other: because in her ascent to the Meridian it is supposed to lift vp the water, but a little declining from the Meridia, it is thought to depreffe & asswage the waters. 8^{ly} if this effect were ascribed to the light of the Moone, then when the Moone shines not, there should be no such motion, because contrary causes produce contrary effects. But wee obserue the same ebbing & flowing in the cōiunction or New Moon, when she hath no light, as in the full Moone, when with full face she beholds the Sea: for in both these times we haue highest tides. These & many more argumēts are vrged by *Pariccius*, to shew that the Moone cannot be the cause of this motiō in the Sea: of the other opiniō, that this effect is ascribed to the Sun, amongst others I find the chiefe patron to be *Tetstus*, who taught that the Sea was moved in this wise, because it would auoide the operation of the Sun, fearing lest it should be too much dissolved into vapours, and so perish. But this opinion seemeth far more weak then the former. For first I would aske concerning this motion, wherein it is thought to auoide the Sunnes heat, whether it be voluntary, or necessary? It cannot be Voluntary, or a free action, because the Sea is no liuing creature, to which only such a motion is incident: If it be necessary, then it is Naturall or Violent: It cannot bee Naturall, because according to *Aristotle*, one Body can haue but one naturall motion, but the Water being a simple Body, hath another motion to fall downewards towards the Center: wherefore it cannot also admit of this. It cannot be violent: first, because no violent

lent thing can be perpetuall. Secondly, no cause can be thought vpon Externall, which should cause this violent motion: and if any such cause there be found, then is not this of *Telefius* the first and principall cause, sith it is referred to a farther cause: Thirdly, no cause can here be shewne according to this opinion, why all other waters, as fresh Riuers, should not likewise strue to hide themselves from the face of the Sun. Fourthly, hee should giue a reason why in the *Belgicke* and *Armoricke* shores, which are far more distant from the Sun, the same motion is no lesse eminent then in *Taprobana*, which is subiect to the Torride Zone; and why in the Island of *S. Thomas*, which is immediatly vnder the Equatour, there is not a greater working of the Water then at *Venice*. Fifthly, that which *Telefius* brings to confirme his opinion, is no lesse warrantable then the maine point in controuersie. In the Summer (saith he) the foulds are lesse, because the Sun raiseth vp thinner vapours, which are easily dissolued: But in the Winter they are lesse, because the Sunne is of least force, and so raiseth vp fewer vapours to worke vpon the Sea: But both these matters are proued false by experience: first because in the Summer wee haue as great a working of the water as at other times: In the Winter also as great, or greater. Secondly (saith the said Author) in the full Moone the motion is greater, because the much light arising from the Moone, drawes vp many vapours. In the New Moone; because the Aire being refrigerated, the internall Heat of the sea collecting it selfe, is made stronger with more vapours: In the quarters of the Moone, because there is not much light cast from the Moone, and the Heat of the sea is not so much collected by the externall cold of the Aire: To all these matters wee may easily answer: First, how can the Moone bestow any light on our seas, when shee is with the *Antipodes*? Secondly, where he saith, that the internall Heat is gathered together, and made stronger by externall cold; 1 First I aske how the sea can send forth these vapours; if the vapours kept vnder doe raise the sea vp; or if the Sea swell with these vapours in her wombe, how can she let them out? 2 How will he proue the Sea naturally to be hot, sith it

is one of the cold Elements? Thirdly, where he saith, that the light of the Moone is but in halfe imparted to the Sea; why should not the Sea proportionally in halfe be stirred vp? wherefore *Patricius* and *Casman* finding neither the Sunne nor the Moone of it selfe to be a sole or sufficient cause of this motion, having ioyned them both together in this causality, and added besides other particular causes: first (say they) there are two kind of causes concurring to that effect: either *Uniuersall* and *externall*, or *Particular*, *internall* and next causes. The *Uniuersall* causes are two; to wit, the *Sunne* and the *Moone*. The *Sunne* (saith he) with the heat of his beames and light doth *conserue*, *vinificate*, and stirre vp to action, the *Internall* and *originall* heat in all things here below. This Heat being stirred vp and vinificated, all things are made fit for motion, and being so accommodated, are stirred vp to motion, as if from an *Internall* life they should be promoted to an *Externall*: for as in the *primary* life of things, the motion and action is shewn: in the *Essence*, in the *secondary*, the action and motion outwardly in respect of other things: so the first and originall heat of the Sea, cherished, & stirred vp by the external heat of the Sun, drives the Ocean, and moues it to action. The *Moone* also cheriseth, preseruetb, *vinificates*, *nouriseth*, and stirres vp to motion, all these earthly humours and moistures: and as she dayly by houres beholds the Sun as her darling and by him is (as it were) big-bellied with lively seedes, so she beholdes her loue, the *Ocean*, dayes and nights, and fills the Ocean with these seeds which she receiues from the *Sunne*. But this cannot be performed without her motion, without the diffusion of her light, without the effusion of her influence & seedes; wherefore it cannot otherwise bee, but all our humours and moistures should be made fruitfull, conceiue life, bring forth, beare fruit, and be stirred vp to life and motion, by the motion of the *Moone*, through the *Aspect* of the Moone with the *Sun*, with the *Earth*, with the *Ocean*: wherefore all lower moistures are subiect to the power of the Moone: Notwithstanding all are not equally vnder her dominio; sith all are not of the same substance, of the same Rarity, or density, or of the same Heat.

This

This much of the vniuersall causes of the motion of the Sea, according to this opinion. The particular or neerer causes are such as are found in the Nature of the Sea it selfe: and these are two: the fluidity deriued from the Radicall and first moisture; and the saltnesse drawne from the originall, and imbred Heat in the Sea. That is most subiect to the dominion of the Moone, this of the Sun: The saltnes therefore of the Sea seemes the neerest and most proper cause, and no other common Nature, why the sea should be stirred with so many motions: for no fresh water is moued with so many, nor suffers any such Fluxe and Reflux as the Sea. Then must the saltnesse bee the neerest and most proper cause: But by what meanes doth it worke? It is answered by *Patricius*, that salt water hath in it more heat then any fresh water whatsoeuer; And though spirits bee hid in all moisture; yet farre more in salt, then freshnesse: wherefore from these spirits existing in the salt humor, is the Sea turned and tossed with so many motions: amongst which, the chiefeest and most remarkable of all is that of the Ebbing and Flowing of the Sea: for by these motions, the Sea as a Terrestriall Heauen, followes and imitates the superior; wherefore it seemes euident, that from such a motion should be deriued the motion of the Sea. This opinion seemes to haue great shew of probability, and to bee more sound then all the rest: but whether it will in euery part satisfy, I much doubt: yet must wee embrace it, vntill such time as a better be found out.

2. *All seas doe not ebbe and flow alike: Neither the same at all times.*

That a great disparity is found in diuerse places of the sea, concerning the afflux and reflux of the Water, is manifest out of many instances, we haue shewed in the former proposition: it will bee enough in this place, to giue some reasons for this variety. This disparity then is found to bee two-fold; for some seas neither ebbe nor flow at all: others ebbe and flow: Again some ebbe and flow more, others lesse. Again in respect of time we shall obserue besides daily comming and going

going of the Waters, Weekly and monthely change, of all which branches we shall have occasion to treat hereafter according to those footsteps, which I finde in the best writers. First therefore the want of this motion of ebbing and flowing in the sea, is by some Authors ascribed to many particular causes. 1. The *Freshness* or want of salt in the Water. 2. The *Crafftitude* & thickenesse of the water. 3. The *Overmuch thinnesse* of it. 4. The extreame *depth* of it. 5. The *narrownesse* of the *Channell*: All which either ioyned together; or in part, may hinder, if not altogether take away, the ebbing and flowing of the sea in those parts: which we shall the better understand, if we instance in some particular seas most remarkable: The *Caspian* sea is reported to be of this condition (although some have doubted,) that it neither *ebbs*, nor *flowes*: This affection is imputed to two causes: First, The want of *saltnesse*; Secondly, the extreame *depth*: By the former it is vnapt to generate *spirits*, which should give a motion: And by the later, the *Sunne-beames*, which concurre to the stirring up of these spirits, are hindred from piercing to the very bottome of the Water: That this sea should little partake of *saltnesse*, may easily be perswaded; forasmuch as 80. Riuers of fresh water, with 5. Lakes of no small quantity, are disburthened in to this sea: Among the which are *Ochus* frō the East; *Curus* frō the West, *Araxis* from the South, falling into it with 40. Inlets; and *Volga* from the North, running into it with 70. Inlets. All which fresh Riuers, some of them exceeding great, must needs make this sea very fresh: To this may bee added, besides the authority of *Contarenius*; confirming this by two other reasons: First the *Trouts* and *Lampreyes*, which is a kind of Fish altogether delighting in fresh Water, are there taken in great abundance: Secondly, that on a certaine coast of it, the Water of it's owne accord congeales into salt: The reason whereof is, because *salt* Water mixt with *fresh* will more easily *coagulate* and congeale into salt. The depth of this sea is also sufficiently warranted by such as write of it, especially the former named *Contarenius*. Secondly, the Lake called *Alphat* is thought neither to ebbe nor flow: which besides these reasons

reasons alleged from the *Caspian Sea*, may be ascribed to the *thicknesse* of the water, not suffering any thing to sinke into it: So that for the crassitude of it, it must needs be heavier then other Water, and so, more vnapt for motion. Thirdly, it is recorded by some that in the inmost creeke of the *Red sea* there is a motion: and so in the mouth of it, by reason of the *Ocean*; but in the middle no such matter is to be obserued: which strange effect some ascribe to the *Thinness* of the Water (one of the causes aboue named) begetting *fewer and weaker Vapours and Spirits*: which either streightway breath out, or are too weake to raise vp the Water. This thinnesse is confirmed to be in that middle part of the *Red sea*, not onely out of the authority of *John Barro*, out of the experiments of *John de Castro*, which found this Water to be cleare and liker to *Chrystall*, then that of other parts; but also by the cleare perspicuity of it. For in almost all the sea may the bottome plainly be seene. Fourthly, we reade the like of the *Baltick* sea: that it neuer ebbs or flowes, which *Burgholmew Kackerman*, that countrey-man, ascribes, 1. To the *Narrownesse* of the channell: 2. To the *depth* of it. 3. To the *northerne situation*: which cause I thinke hee might well haue spared, considering that more *Northerne* seas then that, both ebbe and flowe. Fifthly: it is reported of *Maotus*, *Pontus*, and *Propontis*, that they flowe from the one to the other, but neuer ebbe: For *Maotus* flowes into the *Pontick* sea as from the Higher place into the lower: and the *Pontick* into the *Propontick*, & *Aegean* for the same cause, but returne not back againe. But besides this cause of this declivity of the ground: it standes with reason, that the Water should be fresher then that in other places of the sea: For first, all of them receiue into them many and great Riuer of fresh Water: for *Maotus Palus*, besides other partakes of *Tanais*. Into *Pontus* fall according to *Arcanus* report about 52 fresh Riuer: whereof the chiefe are *Ister*, *Hispans*, *Borisphenes*, *Tanais*, *Phaistr*, all great currents. Secondly the forenamed fishes, which delight in fresh springs are here also found in abundance, Besides this freshnesse (if wee beleue ancient writers, as *Pliny* and others) it is a sea of
extra-

extraordinary depth, so that for this cause some part of it was called *Negrepon*, or the *blacke-sea*: Which blacknesse was by some, thought to arise from the depth of it: wherein in many places, they could sound no bottome. Sixty, it is testified of the *Tyrrhene*, *Ligurian*, and *Narbon* seas, that they suffer not this motion: The cause of which is onely ascribed to the extreame depth, for few or no Rivers are disburthened into it, except *Rhodanus*. We are in the next place to shew, why this working of the sea is more in one place then in another: The reasons whereof (although many be thought on) are chiefly reduced either to the excessse of saltnesse in the water, or the narrownesse of the channell, into which from an open place the sea is to be disburthened; or the shallownesse of the shore: All which either concurring together, or taken by themselves a part, may cause the sea to swell more in one place the another; which may, as the former, bee proved by diuerse Instances. Fourse Seas are more particularly noted to flow and swell higher then other. The first is that compasseth about *Europe*: from *Hercules pillars*, which according to diuerse shores, takes diuerse names; as the *Portugall*, *Cantabrian*, *Gallian*, *Belgicke*, and *British* Seas. And in the New World, or *America*, the Southerne Sea shall be the second: The third is that of *Cambaya* and *India*: The fourth is that which compasseth about *Taprobana*: for the three last, the causes fore-specified, seeme manifestly to concur: for *Taprobana* is reported by *Pliny* to haue a shore not aboue sixe paces deepe, and the Sea to be Greene and ouergrowne with weeds, in so much that the tops of the weedes fret their ships; and later Writers report, that the Land is knowne to augment the confines by reason of the shallownesse of the Water: so as wee haue shewed that some Seas neither ebbe nor flow by reason of the depth of the channell; so on the other side must it follow, that other Seas ebbe and flow more by reason of the shortnesse and shallownesse of the shores: for of contrary causes proceede ordinarily contrary effects. Moreouer it stands with experience, that in any Water or Sea, where the flood is stopped and hindred by quicke-sands, it returnes with greater force, as it were enraged.

ged, and swels so much the higher, which is the cause why in the coasts of *Cambai* it is lifted vp so high, because the shores are so shallow, and so short, and exposed to impediments, that in the ebbe, the Sea runs backe many miles, & leaues the sands vncovered: Whence it must needs returne with greater violence. This also is found in the *Indian* Sea, and neere *Panama* in the *Southerne* Sea, where the Sea running back for two leagues, certaine *Ilands* and *Lands* are left naked; so that in these three Seas here named, the Sea seemes to enlarge its limits in bredth more then in other places; to which we may ascribe this effect. For the Seas about *Europe*, wee may pronounce also that for the most part they haue short & shallow shores, as may easily appeare in the confines of *Belgia*. But it may be objected of the *Englische* shores, that they swell very high, albeit the depth of the Water in the middle is found to be 144 foot: Here must we haue recourse to the other cause, the flowing of a large & wide sea into a narrow channell: for the large torrents of water running swiftly into a narrow channell, being hindered on both sides by the shores, from spreading it selfe in bredth, is enforced to swell in hight: so that the effect is rather to be ascribed to the violence of a great current, enbosoming it selfe into a streite channell: which may more evidently shew it selfe in 3 instances: For in the streite channells of *Zeland* and *Holland* it is lifted vp about three foote: At *Bristoll* in *England*, by reason of a greater force of Waters running from the Sea into a more narrow channell, and seconded by the maine Ocean at the backe, it swels to the hight of 60 foote: In the *Armorean* seas, where larger seas are emptied into more narrow streites then the former, it increaseth to 90 foote: Out of which experiments may wee plainly collect, that to the increase of the motion of the sea besides the saltneesse of the Water, two other causes are concurring; to wit, the shallownesse of the shore, and the streitneesse of the channell, wherein a great and large sea is to bee exonerated. This may lastly bee farther illustrated from the disparity of these seas with others, for in the *Adriaticke*, *Egean*, *Ionian*, and almost all the *African* seas, the sea seldome swels to so great a measure: whereof

the

the cause is as well the depth of the seas, as the equality of the shores: for as the depth is a cause that sometimes it flowes not at all, and the inequality and shortnesse of the shore that it flowes high: so a meane hight of the Waters from the bottome, and a more equall figuration of the coasts may bee a cause of an indifferent working of the Water. Hitherto wee haue shewed the variety of motion in the sea, in regard of the diuersity of places: wee are next to speake something concerning the variation of it in regard of the times, which, though it properly appertaine not to Geography, yet am I loath to leaue it out, because the discourse is pleasant. Concerning which point, the Marriners make six degrees of change in the tides according to the times. First diurnall, whereof wee speake in this discourse: The second Hebdomedary, or weekly which *Possidonius* called monethly or weekly; because it is distinguished by seuerall weekes of a moneth: but carries not till the end of the moneth: For it is found by experience of Nauigatours that a day before the coniunction of the Moone with the Sunne, and the day of coniunction, and a day afterwards, the seas in the maine Ocean haue their greatest flowes and ebbes, being lifted higher and laid lower downe, and then the tides are most swift: The fourth day from the coniunction, the tide is lesse and lesse swift: The fift yet lesse then then the former; and the sixth day lesse then the fift: But in the seuenth day, which is a day before the quarter, and in the eight following, wherein it is *halfe-faced*; and in the ninth, which is a day after the quarter, the sea is, as it were, dead, not much stirring, neither much ebbing or much flowing; which was (as it seemes) only obserued by *Pliny* in the *Euboian Euripus*; but whether it so happen else-where, I leaue to men experienced in these matters; This motion as it doth encrease according to the age of the Moone: So it is said proportionally to decrease againe. The third motion is monethly, which seemes in the time of the coniunction, wherein the sea-tides are highest and swiftest: The fourth is called *motus semestris* or *six-monthly*, happening at the times of the Equinoctiall; differing one from the other like monethes; The fift is called *Trimestris*,

because it happeneth onely in three moneths distance. The last is Annually which *Patricius* witnesseth that himselfe saw in *Liburnia*, in the moneth of *January*. These motions I carelessly passe over, because the distinction seemes to me full of vncertainty and scarce warranted; and such experiments as are brought, for the prooue of it concerne rather particular places, then the generall nature of the sea.

3 Hitherto of the generall motion of the sea : The *Speciall* is that, which is obserued in some speciall places.

1 It is probable that the sea is carried somewhere from East to West, and somewhere from North to South, and contrariwise.

It hath beene a receiued opinion amongst Philosophers of this later age, that the sea by the rapture of the heauens should be moued round, as it were, in a diurnall course: which they haue laboured to proue by diuers experiments. First, because it is obserued by Marriners that a ship can well saile from *Spaine* into *America* with an indifferent winde in 30 dayes, when she can hardly returne vnder three moneths, which they ascribe to the circular motion of the sea: For a ship going from East to West sailes with the Water, but from West to East against the streame, so that the one must needs bee swifter and the other slower. Their second experiment to confirme this point, is of a ship sayling from *Spaine* to *Holland*, which may as they say swifter returne backe then goe thither. To this motion of the Water from East to West, *Iulius Scaliger* hath added another, which he would haue to be from North to South, from *Terra Laboratoris* Southward. But *Patricius* not denying these motions, would haue many more in diuerse seas, not admitting any vniuersall circular motion enforced by the heauens, but various motions diuersly disposed in diuers seas, for which hee giues many instances, some whereof wee will here relate. First going about to disproue

Scali-

Scaliger's opinion and experience, hee brings the experiment of the *Portugall* Navigatours, who testifie that they came from *Mosambicke* of the side on *Madagascar* into *Malebar* in 28, sometimes in 30, other times in 35 dayes: which is farre from the accompt of *Scaliger*, who would not haue a ship to passe it under three moneths, out of which he laboured to proue this motion of the sea, because the shippe was longer a going then returning. The second experiment hee takes from the obseruation of one *John Eupoliis*, who willing to passe from the port of *S. Blasius*, which is beyond the *Cape of good hope* in *Africke* to *Melinde* towards the Indies, could not goe forward by reason that the currents, (as they call them) droue them backe from *Melinde* to *Pate*, a towne by this side of the *Indyes*: whence hee would conclude that the Water should in this place rather runne from West to East towards the Indies. The third experiment is drawne from the testimony of *Thomas Lope*, who when he was to passe from the *Cape of good hope* towards the Indies, testifies that the current of the Water was so violent, that it oftentimes leapt into the forepart of the shippe. The fourth is from the testimony of *Johannes Guieranus*, who putting forth from *Tidor*, came into *Spain* before the sixteenth moneth: This iourney from *Tidor* to the *Cape of good hope*, containes 55 leagues, which makes 1650 miles: from this to the Island of *S. Helena* by the relation of another pilot are 1400 miles: from whence to the Equinoctiall circle are 1600 miles: from hence to *Spain* by the computation of degrees, are not aboue 1520 miles: of all which the summe is, 7114. Now if wee take out of sixteene moneths 49 dayes, wherein the ship against *Cape of good hope*, was carried hither and thither (which the mariners call *Voltegiare*) and 70 other dayes wherein it stood still in the coasts of *Guinea* in *Melacia*, there will remaine a whole yeere spent in this iourney: which dayes if we diuide by those 7114 miles, there will be allotted to enery day no more then 19 miles, which euidently shewes that this iourney was most short in respect of the swiftnesse of the Navigations. For if the Ocean should driue his currents

to *St. Helena* even to the west, they had ended their journey in a farre lesser time, because those currents (as they say) carry the ship. But this journey was accomplished very slowly: wherefore the currents were not carried from East to West, as *Scaliger* relates. Likewise from sundry other experiments, hee goes about to prove that it constantly cannot be observed to flow from North to South, as the said *Scaliger* affirms, but that it is various according to diuers places. Nevertheless, that the Sea should have a perpetuall current from the Poles towards the Equator, seemes to stand as well with Reason, as Experience: For all men must needs confesse, that the motion of the Heavens vnder the Equator, must bee much swifter then neerer the Poles, because the circles of it are greater neere the Equator. Now by how much swifter the motion of the Heavens is, by so much more is the Rarefaction of the Aire, or other Elementary bodies right vnder it: whether it be Aire (as it is most probable) or Fire as *Peripateticks* imagine: But howsoever we determine that contraries be, it must needs be that the Aire must suffer Rarefaction, answerable to the swiftnesse of the motion: if not immediately by the swift motion of the Heavens, yet by a consequent by the greater fervour of the Fire, which vnder the Equator must needs be greater and of more force then about the Poles: whence the parts of the Aire vnder it, must partake more degrees of Heat, and by necessary consequence suffer a greater Attenuation. 1. The Sun-beames being darted perpendicularly, cannot choose but attenuate and rarifie the Aire more vnder the Line, then in places more declining to the Poles: This ground thus laide, these two consequences will follow: 1. That the Aire thus attenuated, must needes take vp a larger place then it before possessed, which cannot be but by enlarging it selfe towards either Pole, either North or South: whence the parts of the Aire in those places must bee more thickned and condensed. 2. That these parts of the Aire carried towards the Poles, and meeting with the cold Regions of the North and South, must by condensation turne into water, and so fall downe in Raine or Snowes; whence the Water

encreasing neere the Poles perpetually, must haue a perpetuall current towards the Equatour, where they are againe exhausted in vapours by the Heat of the Sunne; in such sort, that as well the parts of the Sea betwixt themselves, as the waters in regard of the Aire, may proportionally maintaine themselves by the mutuall transmutation. To this reason some haue added another, that the Sunne sojourning in the Southerne Signes, is neerer to the Earth, then when hee is in the North, by the whole Latitude of his excentricke, and therefore of greater force to draw the water toward the South: But whether this Reason be of any great force, I will not spent time to dispute: let euery man vse his own iudgment. It seemes to me a coniecture not improbable, that these currents may bee also varied according to diuers reasons of the yeere; as also according to diuers channels, by diuers crossings and doublings of the Tides, as wee find in diuers places: but I will not be too bold in this opinion, because I loue not to walke without a guide in these vncertainties.

4 Of the Naturall motion of the Sea we haue spoken: It remaines we speake somewhat of the *Violent*: The *Violent* motion is that which is stirred vp by windes.

The consideration of windes is either absolute or respectiue: Absolute I call that wherein the Naturall effects and properties of the winds are handled; which properties belong to the naturall Philosopher, they being (according to *Aristotle*) a Naturall body vnperfectly mixt: The Respectiue consideration is that wherein the windes are considered in respect to the Terrestriall Globe. This Respect againe twofold, either in regard of the whole Spheare of the Earth, wherof they designe out the points of the Horizon by certaine lines called *Rhombus*; or else in respect of the Sea, to which they giue a motion: The former respect we haue handled in our first booke of *Geography*: The later is more proper to this place; & howsoeuer the wind is an exhalation, common as well to the Earth

as to the Sea, affecting both with some alteration; yet because it more neerely affecteth the Sea as his proper Prouince and Dominion, and hath for the most part bene most obserued of Sea-men and Mariners; Wee thought fit to treat of it in this place. Of windes some are vncertaine and variours, which in all places interchangeably supply their turnes, keeping no certainty or regularity in times or places: others are called, fer or standing windes, because they are obserued to blow at certaine time, and places: of both which, as much as conednes our purpose, we shall speake in these two Theoremes.

*1 To some certaine places, at certaine times be-
long certaine windes.*

These windes are by some, called *Anniversary* because they blow at a certaine season euery yeere; of these there are many kindes mentioned by Nauigatours. The first and chiefest is that which they call the *Etesian* winde, which is obserued to blow euery yeere from the Northeast about the rising of *Dog-starre*, and oftentimes continues about 40 dayes. This wind driues the Seas from *Pontus* into the *Egean* Sea, euen so farre as *Egypt*. In the second place may wee range such windes as are called *Chelidonian*, because they arise at the first coming of the Swallowes. It blowes sometimes from the *Direct-west*, so that of some it is taken to be the same. Sometimes from the *North-west*, so that with others it is accounted among the North windes: These *Chelidonian* winds driving from the North or North-west still fill all the *Mediterranean* euen to the coasts of *Syria* and *Palestine*; and continue in the summer time for many dayes together. In the third place may we accompt that winde, which *Columbus* perceiued on the coast of *Portugall*, coming ouer the *Atlanticke* Ocean, which at some times of the yeere was carried higher, at other times cleauing (as it were) to the bosome of the Sea, whence hee probably coniectured that it was deriued from some moist land, whereon hee aduentured on the first search of *America* and layed the first worke of that discouery. Fourthly to these winds

windes may be reduced those yeerely flowings of the *Persian* and *Indian* Seas, which the *Portugall* mariners call *Motions*. The *Persian* Sea suffers such a kind of motion euery yeere while the Sunne runnes through the *Southerne* degrees, and when he arriues at the end of *Sagittarius* it is shaken with an extraordinary great tempest: On the contrary side the *Indian* Sea, while the *Persian* is moued, is obserued to rest without any great motion; and when the *Persian* is still, it suffers great motion, especially when the Sunne first enters into *Cancer*. This last motion seemes to be not only deriued from the *Provinciall* windes, but some other concurrent causes; whether these winds are the cause of the currents before spoken of, is a very disputable point, which I leaue to others to search out. Of euery set winde blowing a part of the yeere on the coast of *America*, *Acosta* treats at large, to which hee ascribes the currents forespoken of in this chapter.

2. *The violence of windes makes the Sea sometimes in some places, transcend his ordinary bounds.*

How far the Sea by violence of windes hath trespassed on the land, many haue learned to their great losse and calamity. It is obserued sometimes in the *Venerian* shores, that the Sea driuen with winds swels so high, that ouerflowing all the banks and channels, the Inhabitants are enforced to row in boates from house to house. Their cisternes are infected with *Salt-water*, and their precious waters in vaults and cellars spoyled. The like hath heretofore beene found (if we will credit Histories) in the *Belgicke* Sea, on which the Northwest windes blow with such vehemency and so long that it brake downe the ordinary banks; and in *Zeland* and *Holland* swallowed vp many towne with infinite multiudes of people. Which seemes to be warranted by a report, I haue heard of many trauaylers, that in a calme tide the topps of towres and steeples haue beene seene aboue the water. Besides these instances, we may adde the testimony of *Strabo* and *Aristotle* in

his booke *de mundi*: with diuers other relations of strange inundations whereof wee shall haue more occasion to speake hereafter.

CHAP. VII.

Of the Depth, Situation, and Termination of the Sea.

THe Absolute proprieties of the Sea being hitherto passed ouer: we will consider next the comparatiue: which agree to the Sea no otherwise then in respect or comparison with the Earth; which are chiefly three: 1. *Depth*, 2. *Situation*, 3. *Termination*.

1. **The Depth or Profundity** is the distance betwixt the Bottome and the Superficies of the Water.

To find out the Absolute depth of the Sea, is a matter of the greatest difficulty, and by many thought impossible; in respect as well of the immensity of it in many places where no line could, as of the various places, too many to be serched out by mans industry: yet where absolute science failes, there probable coniecture takes place, and is best accepted, which wee will venture to propose in this our Theoreme.

1. *The ordinary depth of the Sea is commonly*
answe-

answerable to the ordinary height of the mainland
above the water: and the whirle-pooles and extra-
ordinary depths answer to the height of the moun-
taines above the ordinary height of the Earth.

It hath been a common received opinion among ancient Cos-
mographers, that the depth of the Sea being measured by a
line and plummet, seldom exceeds two or three miles, ex-
cept in some few places neere *Suenian* shores, and some places
about *Pontus* observed by *Pliny*. But as *Breewood* a worthy
late writer observes, this position is not to be understood ge-
nerally, but only of the depth of the Straits, or Narrow Seas,
which were perhaps only searched by then ancients who
dwelt far from the maine Ocean: But another account is ne-
cessarily to be given of the maine Ocean. This being a matter of
great vncertainty, wee will follow the conceit of the forena-
med Author. It hath been shewed in the former Chapter, that
the most probable opinion concerning the manner of the first
separation of the dry land from the waters would haue the
Earth by the Creation to be cut into diuers flues & channels,
apt to receive Water. Now these materiall parts of the Earth,
being taken out to give way to hollownesse, were not utterly
annihilated, but by an almighty hand in some other places, ma-
king by their addition the superficies of the Earth in such pla-
ces higher then before: whence by reason it seemes to bee
collected, that the ordinary Eminency of the height of the
Earth above the Waters, should bee answerable to the ordi-
nary depth of the Sea. And if Hills and Mountaines be compar-
ed, wee may set them against the Deepes and extraordinary
Whirle-pooles and Gulles: And so betwixt the Sea and Land,
and the parts of the one and the other, we may settle a kind of
agreement and proportion: In a matter of so great vncertain-
ty, no man will expect an euident demonstration.

3 The Site is the position of the Sea in respect
of the Earth.

Concerning

Concerning the fire of the Sea in respect of the Earth, wee must consider the Water and Earth two wayes: First Absolutely as they are Elements and solide Bodyes: Secondly, in respect of the superficies of either; if we consider the whole solide Body of the Water as that of the Earth, we must confesse without all doubt, that the Water hath the higher place, being lighter then the Earth; of which situation wee haue spoken in the first booke: for although some parts of the Earth are thought (by most as we shall proue) to be aboue some parts of the Water, yet is this of no sensible proportion in respect of that vast Masse of Earth; couched vnder the Waters betwixt them and the Center of the World. But the question is here of the superficies of the Water, compared to the superficies the Earth vncouered, which should be higher in place; of which shall be this Theoreme.

The superficies of the Sea is some where higher then the superficies of the Earth, some Where lower.

There hath beene a great dispute among Philosophers concerning the position of the Sea in respect of the Land, whether it bee higher or lower: some haue beene of an opinion; that the Water is higher; which opinion was defended by *Tully*, in his Booke *De Natura Deorum*, where hee saith, that the Sea being placed aboue the Earth, yet couering the place of the Earth, is congregated and collected, neither redounding, nor flowing abroad: which afterwards seemes to be seconded by diuers learned Diuines, who reducing most things to the supernaturall and first cause, diuers times neglected and ouersight the second. Hence *Saint Basil* in his 4 *Homily* on the *Hexameron*, lett the water (saith hee) should overflow and spread it selfe out of the place it hath occupied, it is commanded to gather it selfe together: otherwise what should hinder the *Red Sea* to over-flow all *Egypt*, being lower then it selfe, vnlesse it were maniced with the *Creators* power, as it were with setters: to which also afterwards seeme

seem to subscribe *Aquinas*, *Dionysius*, and *Catharinus*, with diuers other Diuines, who held that the first discouery of the Earth, and the gathering together of the Waters in the first Creation, was made not by any mutation in the Earth, but (by a violent accumulation of the Waters being (as it were) restrained and bridled supernaturally, that they could not transcend certain limits and bounds. To confirme this opinion, some reasons are alleaged by moderne Philosophers: first because it is the order of all the Elements amongst themselves, that the Earth, as the heauiest, should take the lower place, and the water should ascend aboue: Secondly, because Marriners coming from the *maine Ocean* to the Land, seeme to see the land farre lower then the Water: Thirdly they alleage that place of *Iob*, where God himselfe professeth, that he hath bounde the Waters, in these words: *Hitherto shalt thou come, and no farther, & here shall thy proud waves be stayed.* But this opinion seemeth very improbable, that God in the first institution of Nature should impose a perpetuall violence vpon Nature: first we see the Creator in other matters to vsie Nature as his ordinary seruant, and to administer the Regiment of things by second causes: Neither were the authority of these Diuines so great in these *Cosmographicall* conceits, to ouerthrowe these of the same profession, who could more exactly iudge of these matters: Neither are these reasons of so great validity as to enforce assent. For first whereas *S^t Basil* seemes to wonder why the *Red Sea* should not overflowe all *Egypte*, if it were not supernaturally bounde; he takes that as granted, which is the question in controverse, that the Water is higher: for which he can produce no other reason, then the Testimony of the sense: but this is very weak, forasmuch as in such matters the sense is oftentimes deceived, as hands well with the grounds of the *perspectiues*: for (as we are there taught) two *Parallels* will in the end seeme to concurre so far as the sight can iudge: Now the Sphere of the *Heauens*, and the Sphericall segment of the *Waters* being parallell the one to the other, will necessarily seeme to concurre to the end, whence it must needs come to passe, that the

that part of the Sea must seeme to lift it selfe higher, and contrarywise the Heavens will seeme somewhat lower then indeed they are: and this I take to be the true cause why the Sea being seene a great way off, may appeare raised above the land whereon we stand. Another reason may be giuen from the perpetuall Refraction of the vsuall Lines comming from the Sea to our sight. For the Aire neere the Sea being alwayes intermixed with thicke watrish vapours rising vp, the Sea must of necessity be presented in a thicker *Medium* by a refracted sight: whence consequently it must seeme greater & higher then indeed it is: for as the *Opticks* teach, all things seeme greater & higher in a thicker *Medium*. To the other three Reasons brought to confirme this assertion it is no hard thing to answer. To the first which would out of the order of the Elements inferre, that the Water is higher then the Earth, I answer (as before) that if we intirely consider these Elements amongst themselves, we must give the hight to the Water; for as much as the greatest part of the Earth lies drowned; for that about beates no sensible proportion in respect of the parts of the Earth vncovered. But here we compare not the 3 Elements intirely betwixt themselves, but the superficies of the Water with the parts of the Earth vncovered, habitable: which superficies of the earth notwithstanding, this reason, may bee higher then the Water. Secondly, where they produce the testimony of the sight; for my own part, I can warrant no such experience, hauing neuer launced far into the deep: yet if any such experiment be atouched, it may easily be answered out of optuall Principles: that coming out of the maine Ocean towards the land, by reason of the sphericall convexity of the water, interposed betweene our sight, and the lower part of the land, those land parcels must needs seeme lesse, as hauing some parts shadowed from our sight: whence it must consequently appeare lower, as couched almost vnder water. From the 3^d reason grounded on Scripture, whereon our diuines seeme most to depend, nothing else is concluded, but that Almighty God hath set certaine bounds & limits which the Waters should not passe: These bounds & limits I take not to be super-

supernatural, as if the water restrained by such a power should containe it selfe, within its owne circuit. But naturall as *clists & bly*, within which, the waters seems intrenched. This opinion therefore being disliked, others haue laboured to defend an opposite position, that the water is lower then the Earth altogether, which opinion beares more constancy with the doctrine of *Arist.* & most of our modern Philosophers. The reason whereon this assertion is grounded, be chiefly these: 1. If the sea were higher then the Earth, what should hinder the water of it from flowing abroad, & ouerwhelming the Earth: with all men will confesse, that the water is by nature disposed to moue downwards to the lower place. If they haue recourse to supernatural bounds, besides that we haue spoken concerning the interpretation of such places of Scripture, as seeme to fauour this opinion; we answere as before, that it is very improbable, that God in the first creation should impose such a perpetuall violence: secondly, we read that in the vniuersall deluge wherein all the world was drowned, God brake open the springs of the deep, & opened the *Cataracts* of heauen to powre down raine continually many daies together vpon the Earth: Of which there had beene no necessity at all; had the sea beene heaped vp in such sort as they imagine: For the only withdrawing of that hand and letting goe of that bridle which gaue the water that restraint, would haue beene sufficient to haue ouerwhelmed the whole Earth. The second reason is taken from Islands in the sea, which are nothing else but parts of the land raised vp aboue the water. Thirdly we find by experience, that a ship carried with the like wind is drinen so swiftly from the port into the open sea, as from the sea into the port, which could not be done if the sea were higher then the land: for it must needs be, that a ship if it were to be carried to a higher place, should be moued slower then if it came from an higher to a lower. Fourthly all Rivers runne into the sea from the inner parts of the land which is a most euident signe, that the land is higher then the sea; for it is agreeable to the nature of the water, to flow alwaies to the lower place, whence we gather that the sea shore, to which the Water is brought from the land, must needs be lower; otherwise the water in running thither, should

should not descend but ascend. This opinion I hold far more probable as being backt by reason, and the Authority of our best Philosophers: yet not altogether exactly true (as we shall shew hereafter. But *Bartholomew Keckermā* in a late German writer holding these 2 former opposite opinions (as it were) in one equall Ballance, labours a reconciliation. In a diuerse respect (saith he) it is true that the sea is higher, and that it is lower then the Earth. It is higher in respect of the *shores and borders*, to which it so comes that sensibly it swells to a Globe or a circumference, and so at length in the middle raiseth vp it selfe and obtaines a greater hight then in those parts where in the middle of the sea it declines towards the shore: Of which parts the hight suffers such a decrease, that by how much neerer the shore they shall approach, by so much the lower they are in respect of the shore: in so much that touching the shore it selfe, it is much lower then the Earth. For this opinion our Author pretends a demonstration: which hee grounds on the 4 chapter of *Aristotle de Celo*, in his second booke, where hee puts downe these two positions; which he calls *Hypotheses*, or suppositions; First that the Water no lesse concurs to the making of a Globe or circle, then the Earth: for it so descends naturally, that it doth sensibly gather it selfe together, and makes a swelling, as wee see in small dropps cast on the ground: Secondly the Water makes a circle which hath the same center with the center of the Earth. Out of these grounds would our *Keckerman* conclude the water in some places to bee higher, in other places to bee lower then the Earth: And hence proceeds he to giue an answer to their reasons who haue affirmed the Earth to bee higher then the sea: What to thinke of the proposition or conclusion we will shew hereafter, but in the meane space I hold this conclusion not rightly inferred out of these premises: For first whereas he sayth that the water by nature is apt to gather it selfe round into an orbe or spheare, I would demand whether such a roūd body hath the same center with the world, or a diuerse center: he cannot say that it hath a diuerse center, from the center of the Earth: First, because (as we haue de-

mon-

monstrated in our first part) the Earth and the Water have but one center: and that the Water is concentricall with the Earth: Secondly from the second proposition or ground of his, out of *Aristotle*; if he meanes such a sphericity as hath the same center with the center of the Earth: I answer, first that he contradicts himselfe, because he gives an instance in small dropps cast on the ground, whose quantity being so small, and conuexity sensible, can in no mans iudgment be concentrick to the Earth. Secondly, out of this ground that the Spheare of the water is concentrick to the Earth, hee confutes himselfe; for according to the principles of *Geometry*, in a Spheare or circle, all the lines drawne from the center to the circumference must be equall. Then must all places in the circumference or superficies of a sphericall body be of equall hight from the center, and by consequence the sea being such a Sphericall body, cannot haue that inequality which *Keckerman* imagines it to haue: wherefore some other demonstration must be sought for this conclusion. I will goe no further then that I haue spoken in the former chapter concerning the figure of the Water: Where I haue probably shewed it to be conicall, and out of this may be easily gathered, how it may be higher then the land in some places, as of the middle of greater seas, where the head of the Cone is lifted higher; in other, lower; as in the narrow streits where the increate of the eminencie is also lesse. The grounds and principles of which we haue laied before.

i *The sea in respect of the Earth is higher in one place then another.*

Besides the naturall conformity of the Water to a conicall figure, (as we haue fore-shewed) whence one part of the superficies must be graunted to be higher then another: wee must needs in the sea acknowledge other accidentall causes which produce an inequality in the parts of the sea: The chiefest whereof are the Equality of inclination in all parts of the water to motion: And the inequality of the channells and shores: whence it commeth to passe that the Water of the

sea

sea being euery where of it selfe equally inclined to motion, is notwithstanding vnequally receiued into channels, so that in some place, hauing (as it were) a large dominion to invade, as in the maine Ocean, it falls lower and euener: In some other places as streites or narrow seas, the water hauing a large entrance from the Ocean, but litle or no passage through it, must needs swell higher, and so one place by accident becomes higher or lower then another: Which farther to confirme diuerse instances may be alleaged out of moderne and ancient obseruations. For diuerse histories giue testimony that sundry Kings of *Egipt* by cutting the *Isthmus* or narrow neck of land lying betwixt the red sea & the *Mediterranean*, laboured to make *Africk* an *Iland* & open passage from one sea to the other: but afterwards they were perswaded to desist from their enterprize: Some say, because they saw the red sea to bee higher then many parts of *Egipt*, and hereupon feared a generall inundation of all *Egipt*, if the passage were broken open: Others haue deliuered that they feared, that if the passage from one vnto another were broke open, and the red sea hauing a vent that way, the red sea would become so shallow that men might wade ouer it, and so instead of making *Africk* an *Iland*, it would haue been more ioyned to the Continent then before. Both opinions consent in this, that the waters of the red sea were by the perpèdicular found higher then in the *Mediterranean*: Moreouer it is obserued that the sea on the west part of *America* commonly called *Mare Del Zur*, is much higher then the *Asiatick* Sea which bordereth on the Easterne part of it: which gaue way to the coniecture of some, that the *Isthmus* betwixt *Panama* and *Nombre De Dios* had been long since cut through to haue made a passage into the *Pacifick* Sea, without sailing so farre about by the straits of *Magellane*; had not many inconueniencies been feared out of the inequality in the hight of the water. The like inequality is obserued by *Vesstegan* in the sea betwixt *England* and *France*: For according to his coniecture, *France* and *England* being one Continent heretofore, and ioyned by a narrow neck of land, betwixt *Douer* and *Callais* the

the water on one side was higher then on the other: which he probably collects out of the sundry flats and shallows at this day appearing on the East side as well on the coasts of England as of Flanders, especially between *Dover* and *Calis*, called by some, our *Ladies Sands*, about three *English* miles in length. Out of which and sundry other probabilities, he labours to prove that all the *Low-countries* were heretofore enveloped with the sea; till such time as the narrow land being either by *Nature* or *Art* cut through, and the Water allowed a free passage, it became *dry land*: but this point wee shall discuss hereafter in place convenient.

4 In the next place we are to consider the termination of the sea: The termination is the bounding of the sea within certain limits.

5 The Limit is the margent or border of land wherein any sea is circumscribed.

The sea is bounded by the land, as the land by the sea: In respect of which termination some seas are called *Maine seas*, others *narrow*. The maine seas are foure; to wit, the *Atlantic* which taketh it's name from the mountaine *Atlas*, by which on the west side it passeth, and diuides *Europe* and *Africk* from *America*. 2 The *Ethiopian* sea running on the west side of *Ethiopia*. 3 The *Indian* Sea hauing the *East Indies* on the North. 4 *Mare Del Zuy* or the *South* sea, situate on the South side of *America*: Which foure in respect of other may be called *Maine Oceans*. The lesser seas are either called *Creeks*, or *streits*: A *Creek* is a place where the water (as it were) embosmes it selfe into the land, having an entrance large from the Ocean, and most commonly streynted inwardly, but no passage through. A *Creek* againe may be diuided into the greater or lesser: Vnder the former in a large sense may we comprehend the whole *Mediterranean* sea, for as much as the sea from the *Maine Atlantic* Ocean

by an inlet is ingulſed into it, but findes no paſſage out any other way, how ſoever it invades a large territorie. The leſſer Creekes are againe diſtinguiſhed into the *Eaſterne* and *weſterne*: The chiefe Creekes found out towards the Eaſt are ſixe in number. 1. *Sinus magnus* which lies betwixt *Mangus* and *India extra Gangem* teaching as farre as the region of *Chalcis*. 2. *Sinus Gangeticus* which is comprehended betwixt *Aurea Cherſoneſus*, and *India intra Gangem*. 3. *Sinus Canthi*, commonly called *Canthi-colpus*. 4. *Sinus Perſicus*, bordering on *Perſia*, and called by *Plutarch* the *Babylonian Sea*. 5. *Sinus Arabicus*, which is commonly called the *Red Sea*. 6. *Sinus Barbaricus*, which by *Pliny* is termed *Sinus Tragladiticus* &c at this day *Golpho de Melinde*. The Creekes lying Weſtwardly are chiefly theſe; Firſt *Sinus Sarmaticus* lying towards the North, betweene *Denmarke* and *Normay*, which is diuided into *Sinus Sirmicus* and *Bodius*, which is called commonly the *Baltick Sea*. 2. *Sinus Grannicus* diuiding the *Muſcouites* from the *Cyrelis* Northward; it is commonly called the *White Sea*. 3. *Sinus Mexicanus* bordering on the city of *Mexico* in *America*, amongſt theſe, ſome would number *Mare Pacificum*, or *Mare Del Zur*: but this we thought fitter to call a maine Sea, then a creeke, being extraordinarily large in quantity. A Strait is a narrow Sea between two Lâds; of ſuch Straits theſe were anciently knowne, to wit, 1. *Fretum Graditanum*, or the *Straits of Gibraltar* of 7 Miles diſtance, diuiding *Spaine* from *Barbary*. 2. *Fretum Magellaniſum*, found out by *Magellane*, which diuides *America Peruviana* from the *Southerne land*. 3. *Fretum Anian*, ſituate betwixt the weſterne ſhores of *America*, &c the *Eaſterne borders of Turary*. Beſides theſe there haue bin diſcovered 3 more, (to wit) 1. *Fretum Davis*, found out by capitaine *Davis* in the yeare 1586, which lyes toward *Groenland*. 2. *Fretum Neſouicum*, or *Waygate*, neare *Nova Zembla*, diſcovered by the *Holländer* in the yeare 1614. 3. *Fretum de Mayre* found out by *William Schbustera* *Bavarian*, taking his name from *Iſaac le Mayre*, by whoſe aduice and perſwaſion he vndertook his voyage. But ſome of theſe latter ſtreits here mentioned, for ought I knowe, may better bee reckoned amongſt Creekes.

Creekes, forasmuch as they haue not as yet found any passage through, though with great losse and danger they haue often attempted the Discouery. Concerning the bounding of the Sea with the land, we will insert the se Theoremes.

- I The Water is so diuided from the dry land, that the quantity of Water is greater in the South Hemispheare, of Land in the Northerne.

That most part of the dry land is situate towards the North, will easily appeare by instance. For toward the North are placed the great Continents of *Europe, Asia*, almost all *Africa*, and the greatest part of *America*: But in the South Hemispheare, we find only a little part of *Africa* & *America*, besides the *South Continent*, which we cannot imagine to be so great in quantity, as it is painted in our ordinary Mappes: forasmuch as all places at the first discouery are commonly described greater then they are. The reason I take to bee this, that the first draught is alwaies confused and vnperfect, wherein a region discouers it selfe vnto vs vnder a more simple figure, neglecting curiosities; but after a longer and more exact search of any Region, will be found in many places ingulfed with diuers *Bayes*, and variously indented; in such sort, as the bound Line compassing it round, making an inordinate figure, and lesse regular, cannot contain so much land as first it might seeme to promise. Moreouer we may further obserue, that those places which in the first discouery haue been taken for the maine *Continent*, or at least for some greater part of Land, haue after ward vpon more curious examination, been found clouen into many lesser *Ilands*: As in *America*, *Cuba* in the time of *Columbus*; and *California* of late, thought to be a part of the *Continent*, and so described almost in all our Mapps; yet since by a *Spanish Chart* taken by the *Hollanders*, discouered to be an *Iland*. The like instance we haue in *Terra del Fuogo*, which since the time *Magellan*, was held a part of the *South Continent*, till *Schouten* by sayling round about

it found it diuided from the main land by *Fretum de Mayre*, carrying the name of the Master of the ship in his discouerie. Neither is it much to be doubted, but that in that large tract delineated out in the Globe for the *South Indies* are contained many Islands, diuided one from the other by *Straites* and narrow *Seas*, which must subtract much from the quantity of the dry land; so that of necessity it must be granted, that the *Northerne Hemisphere* takes vp the greatest part of the dry land as the other of the Water. Wherefore that place of *Esdrae* where he saith, *That Almighty God allotted his parts to the Earth, and the fountaines to the Waters*; must rather seeme improbable, or suffer another interpretation then that of the ancients. For our credible coniecture drawn from the view of the face of the Terrestrial Globe, we shall hardly collect such a proportion in this comparison of the *Northerne Hemisphere* with the *Southerne*; we shall find a kind of Harmony betwixt the *Heauens* and the *Earth*. For, as *Trauellers* report, the *Northerne* parts abound with more starres, and of greater magnitude then the other toward the *South*; so the Terrestrial all Sphere discouers vnto vs more continen; greater Islands, and of more enote, in the North then in the South.

The whole Globe of the Earth is inuironed round from the East and the West with sea, diuiding the North from the South.

To prove this Theoreme we need goe no farther then the famous voyages of *Magellane*, *Drake*, *Candish*, and *Schanten*; Whereof the first attempted, the first passage through *Fretum Magellanicum*, and gave it the name, though he could not out-line his intended journey. The two next followed the same way, and the last found out a new passage through *Fretum de Mayre*, as we haue formerly mentioned. Whence we may easily deduce this *Corollary*, that the *Southerne continen*, not yet perfectly discouered, is either *One*, or (which is most probable) *many Islands*: forasmuch as by sailing round about it, they haue found it enery where compassed round with Sea. The like may be coniectured of the other parts of the world, on

the Northern side, whereof we shal speak in this next Theore.

3 *It is probable that the Earth is compassed round with the water from North to South.*

I know nothing which hath exercised the witts and industrie of the Nauigatours of our age, more then the finding out of a passage Northward to *Cathay*, and so to the *East-Indies*, which controuertic as yet remaines altogether vnanswered, and awaites the happinesse of some new discovery. In which difficult passage, wherein many haue spent both their liues and hopes, it may seeme enough for me to goe with their Relations; suffering my coniecture to flye no farther then their failes. The reasons which I meet with in my llder reading, I will examine as I can, without partiality, and so leaue euery man to bee his owne Iudge. First then wee must consider that the voyage to the *Indies* must be effected by either of these two waies; to wit, *Northward*, or *Southward*. To beginne with the *South*, it must be performed two waies; either by some vnkowne passage through the *South-Continent* neare the *Antartick* Pole, or neare the *Magellane Straits*. The former is most vncertaine, for want of discoveries in those vnkowne and remote parts: and if any such passage were found out, it were litle aduantage to our Countrey-men, who haue already a shorter and nearer way: yet no instance can bee giuen to the contrary, but that this part being clouen (as it seemes most probable) into many lesser lands, may admit of such a passage: But in such vncertainties it is as easy to deny as to asirme. The second *South-passage* is found out by Nauigatours, which is either by the strait of *Magellane* it selfe, or else through the *Straights of Mayre* before-mentioned, which this Age of ours hath put out of doubt. The third passage is *South-east* by the *Cape of good hope*, knowne vnto our *East-Indian Merchants*, and therefore as a matter vnquestioned, needs no further examination. The onely matter which troubles men in this Age, is the finding out of a passage *Northward* to *Cathay*, either by the *North-east*, or *North-west*; wherein we will consider two

things: 1 Whether it be likely, that any such passage should be at all? 2 whether this passage should be performed by the North-East, or North-West. For the former many arguments are urged which seeme to crosse this opinion, of a way to the *Indies* toward the *North-parts*: For The manifold attempts of the *English* and *Hollanders*, both towards the *North-East* and *North-West*, either altogether spent in paine or failing of their ends, seemes to giue large testimonie, if not of absolute impossibility, yet at least of the vnlikely-hood of any such discovery as is hoped. For what cost or dangers would not almost all the Marriners of our *Northerne* world vndergoe, to find so neare a cut to their golden *Indies*? and if by chance many of them mistooke the right way, yet would it seeme improbable, that latter Navigatours corrected by the former errors, should not after so many trialls and attempts, at length hit the marke. This reason fauours of some probability; yet comparing this with diuerse matters of the same kinde, would seeme to be of no great force. For the truth and right being onely one and the same, is opposed by infinite errors: so that it may seeme easier to commit a thousand errors, then once to hit the truth: Time and long triall beget many Inventions; which afterward seeme most easy: inso much that many men haue afterward laugh at their owne mistakes. Moreover, for ought I can find in the Relations of most mens discoveries, the passage which they sought was too farre Northward towards the Pole; where being infected with cold, Ice, and other inconueniences, they were enforced to retaine thence againe, hauing seldome had any opportunity to winter in those parts for want of victuals, or extremity of cold. A second reason against this *North-passage* may bee drawne from the innumerable sorts of beasts wherewith *America* is stored: for admitting this passage, we must needs grant *America* to bee an Island. Now it is certaine that *Noah's Arke* was the store-house and Seminary; not only of mankind, but of all other perfect living Creatures. Again, it is euident out of the Holy Scriptures, that the first Region where-

whereon the Arke was deliuered of her burthen, was *Asia*. These grounds layed, I would demanda how such a multitude of beasts of all sorts, should be transported from *Asia* to *America*, being supposed to bee an *Iland*, and euery where diuided by the Sea from other parts of the Earth could these silly creatures of their owne accord swimme from one shore to another? but alas! the Sea was too large, and these beasts too fearefull to aduenture on such a voyage. And admit some by Nature had bin fitted to such an action, yet were it very strange to imagine the same effect of all, being of many kinds. What then? were they transported in ships? But Navigation in those daies being an infant, vnfurnished of the *Chart* and *Compass*, durst not aduenture into the *Ocean* so farre out of sight of land. But to gine the opposite part all reasonable advantage, admit the *Straites* diuiding *Asia* and *America* were very narrow, and within kenne; was it likely that from hence they could by shipp transport so many kndes of creatures? Could we beleue any man to be so mad, as to carry o-uer with him *Lions*, *Beares*, *Tigers*, *Foxes*, and other innumerable sorts of rauinous and vnprofitable beasts, as pernicious to mankind, as other creatures seruing for his vse? If any were found so foolish or malicious, yet were it very vnlikely hee should transport so many kinds. This argument seemes no more to concerne *America*, then most *Ilands* of the World, wherein we find diuers creatures, not only seruing for the vse of man, but many vnprofitable & hatefull to the Inhabitants: The meanes of this transportation is very difficult to finde. *St Augustine* with some other Diuines haue bin driuen to a supernaturall cause, as if Almighty God should performe this matter by the ministry of Angels, which answer we dare not vtterly reiect, being supported by the authority of so great a Pillar of the church: yet I cannot so easily imagine, that God who vsed naturall meanes for the preservation of all li-uing creatures in the Arke, should haue recourse to a supernaturall power in the propagation of these creatures on the face of the Earth: wherefore to me the reason would seeme better answered out of our ground which we shall proue hereafter.

That Ilands were not from the first Creation, but afterward broken from the maine Continent by the violence of the Water: Hence it might come to passe, that such beaſts as were in the parts of the Earth ſo broken off, haue ſince there continued by continuall propagation vntill this day; I meane of ravenous and hurtfull beaſts: becauſe of the others leſſe doubt can be made, but that they might be conveyed from one Country into another by ſhipping, to ſerue the neceſſity of mankind. Here we ſee that no argument as yet hath bin vrged ſo ſtrong againſt the *North-paſſage*, but may with reaſonable probability be answered. It remaines in the ſecond place that we deſcend ſomewhat to particulars, to inquire whether this be to be effected either towards the *North-eaſt* or the *North-weſt*: The *North-eaſt paſſage* hath heretofore bin attempted by many of our *English* Nauigatours, but with vnhappy ſucceſſe: yet were not theſe voyages altogether fruitleſſe; for as much as by this meanes, away was found out to *Ruſſia*, whence began the firſt trade betweene ours and the *Ruſſian* Merchants: But that little hope can hence ariſe, ſundry reaſons may be alleaged, the chiefe whereof are theſe; 1 The dangerous rending of the *Seythick Cape*, ſet by *Ortelius* vnder 80 degrees Northward, together with the perillous ſailing in thoſe Northerne Seas alwayes peſtered with Ice and Snow; ſeconded by diuerſe *Bayes* or *Shelues*, *miſts*, *fogges*, long and darkſome *nights*, moſt aduerſe to any happy Navigation. 2 The obſeruati- on of the Water, which is more ſhallow towards the *Eaſt*, which giues ſmall hope of a through paſſage, becauſe all *Seas* are ſed with waters, and for the moſt part are obſerued to be more ſhallow towards the ſhore then in the middle: But where in ſailing forward, any Sea is found to decreaſe in depth; it is a likely argument, that it is rather a *Creeke* *Bay* or *Riuer*, then a *Straite*; Notwithſtanding theſe reaſons, ſome haue heretofore gone about to proue a paſſage by the *North-eaſt* to *Cathay*; of which opinion was *Antony Jenkinſon*, whoſe reaſons be well answered by *St. Humphrey Gilbert*, which I briefly touch, adding ſome things of mine own, as I find occaſion. The firſt reaſon was drawne from

from a Relation of *Tartarian*, who reported that in hunting the *Morse* he sailed very far towards the *South-east*, where in he found no end; which might give a likely coniecture, that it was a passage throughout. But to this we may easily answer, that the *Tartarians* are a barbarous Nation, altogether ignorant of Navigation, which neither know the use of the *Charte*, *Compass*, or *Celestiall Observations*; & therefore in a wide Sea know not how to distinguish the *North-east* from the *South-east*: Besides the curious search of this long passage must depend on better Discoveries then a poore Fisher-man, who seldome dares adventure himselfe out of sight of land; besides, the Fisher-man iudging by sight, could not see about a kenne at sea, which will proue nothing in regard of so long a distance. The second Reason urged by Mr. *Jenkinson*, was this: that there was an *Unicorne's* horne found vpon the coasts of *Tartaria*, which could not come (saith he) by any other meanes then with the tide in some *freight* in the *North-east* in the frozen Sea, there being no *Unicorne* in all *Asia*, sauing in *India* and *Cataia*. To this reason I may answer with Sr. *Humphrey Gilbert* many waies; 1 We may well doubt whether *Tartarians* knowe a true *Unicorne's* horne, or no: 2 It is credible, that it could bee driven so farre by the Tide, being of such a Nature that it cannot swimme: 3 The Tides running to and fro, would haue drinen it as farre backe with the *Ebbe*, as it brought it forward with the *Floud*. 4 the Horne which was cast on this coast, might be the Horne of an *Asinus Indicum*, which hath but one Horne like an *Unicorne* in his fore-head, whereof there is great plenty in all the *North* parts, as in *Lappia*, *Noruegia*, *Finmarke*, as *Zeigler* testifies in his History of *Scandia*. 5 Lastly, there is a fish which hath a Horne in his fore-head, called the *Sea Unicorne*, whereof *Martin Frobisher* found one on the coast of *Newfound-land*; and gaue it to *Queene Elizabeth*, which was said to be put into her wardrope. But whether it be the same which is at this day to be seene at *Windsor Castle*, I cannot tell. The third and strongest reason which was urged for the *North-east* passage was this: That there was a continuall current through the

Frozen

Frozen Sea, of such swiftnesse, that if any thing were throwne into the water, it would presently be carried out of sight. To this we may easily answer, that this strong current is not maintained by any Tide coming from another Sea; but by diuerse great Rivers falling into this *streight*: In like sort we find a strong current from *Mæris Palus*, by *Pontus Euxinus*, *Sinus Bosphorus*, and along all the coast of *Græci* (as *Contarinius* and diuerse other affirme out of their own experience) and yet the Sea lyeth not open to any other Sea; but is maintained by *Tanais* and diuerse other rivers: so in this *North-east* part may this current of water be maintained by the Rivers *Dniua*, *Ob*, and many others which continually fall into it.

Hitherto haue we treated of other passages, either effected or attempted to *Cathay* and the *East Indies*. The last and most desired and sought in our time, is that by the *North-west*. This way hath bin often attempted, as by *Cabot*, *Danis*, *Frobisher*, *Hudson*, *St Thomas Burton* and others; but as yet not found out. Neither hath it more troubled the industry of *Mariners*, then the wit of *Schollers*, which we shall find by discourses written of that subiect. The absolute decision of this controuersie we must leave to time: onely such probabilities as I chance to meet with, I will faithfully set down, to giue encouragement to their deservuing labors, who shall farther attempt the search and full discouery of this *North-west* passage. The Reasons I find vrged, I may well reduce to three Heads: The first is drawne from the testimonies and opinions of ancient Writers: The second from the Relations and discoueries of later Navigators, from the time of *Henry* the seventh, till our age: The third and last from the last and newest adventures of men of our time, either lately dead or living. To begin with the first, we shall from the testimony of *Plato* in *Timæo*, as also in his Dialogue called *Critias*, draw a probable argument: for there he makes relation of an incomparable great Island, named *Atlantis*, of larger extent then *Europe* and *Asia*, which was situate Westward from the streights of *Gibraltar*, and nauigable round about. The Princes of this Island

(according to *Plato's* report) heretofore extended their government ouer a great part of *Europe* and *Africa*. To second which opinion of *Plato*, we shall reade in *Marinus Siculus* his History of *Spain*, that in the *American* golden-mines, discovered by *Columbus*, there haue bin found certain pieces of Coine, ingraven with the Name and Image of *Augustus Caesar*, which were afterward sent to the Pope by *Iohn Rufus*, *Archbishop* of *Consentium*; whence a probable coniecture seemes to be grounded, that *America* in those dayes was both peopled and discovered. Now it appeares againe not only by *Plato*, but also by the opinion of *Marcellinus Ricinus*, *Crantor*, *Proclus*, and *Philo Iudaeus* is witnessed in their learned Commentaries on *Plato*, that this Iland called *Atlantis*, some 600 yeares before *Plato's* time, suffered an extraordinary inundation, & was swallowed vp by water: other like examples whereof we shal produce many, hereafter in place conuenient: admitting these testimonies of antiquity, whereof we ought to cherish a reuerend esteem, these coniectures will seeme to offer themselves by way of necessary consequence. 1. That this Iland *Atlantis* was the same which afterward from *Americus Vesputus* got the name *America*: because wee find no Iland in the *Atlanticke* Ocean which comes neare that greatnesse and quantity assigned by *Plato*: 2. that this *Atlantis* or *America*, in those dayes at least was an Iland; because they reported it to bee Navigable round about. 3. It must stand with great reason & probability, that this land being an Iland before *Plato's* time, should be so still, if at least it come not nearer to the nature of an Iland at this day, then before. For either this Relation of the ouerflowing of this land is true or false: If at all it deserues credit; more reason is, that it should be Navigable round about then before: insomuch that the Water in this manner swelling high; would sooner fret through and cause a passage, then make a stoppage. 4. This passage must of necessity be toward the North-west where *America* is diuided from *Asia* by the streites of *Anian*, which opinion seemes better warranted, forasmuch as we find it seconded by the descriptions of many Geographers of great name

name and authority, as *Gemma Frisius*, *Munster*, *Appian*, *Hunterus*, *Guicciardine*, *Micbael Tramafius*, *Franciscus Demongenius*, *Bernardus Piteantius*, *Andreas Vanafor*, *Tramontanus*, *Peter Martyr*, and *Ortelius* in his generall Mappe: Who all haue described *America* as an exact *Iland*; setting downe all the coasts and countreyes on the North-west sea of *America* from *Hoche-laga* as farre as *Cape Haremantia*; all these learned men hauing with one voice described or reported *America* for an *Iland*; He should shew but a slender esteem of *Antiquity*, or fauour of too much *selfe-conceite*, who should offer to contradict. This first Argument I confesse I punne out in to so many circumstances, seemes at first sight to carry a great shew of truth; but vpon sound examination will be found very defectiue, and vncertaine, carrying more probability in the conclusion, then the premises doe to iustify. How many *Paralogismos* and vncertaine grounds are involved in this reason, let my ingenious reader iudge; 1. whether *Plato's* report of this *Atlantis* were a true Relation grounded on experience and obseruation, or a pleasant *Fiction* deriued from the Poets of that time, wherewith the *Grecia Learning* was much infected; 2. How comes it to be thought probable that *Plato* in those dayes should be so exact in delineating out the boundes of this *New-world*, who was so ignorant in the old, as to thinke *Europe* and *Asia* to be inferiour in greatnesse to *America*, which notwithstanding he thought to be an *Iland*. 3. How should so famous a King as *Atlas*, stretching his Monarchie (as the Authors of this reason report) from *America* to a great part of *Europe* and *Africk*, in that vast gulfes of time, slippe away with so slight a mention: That there was such a Prince as *Atlas*, I make no question; vpon whose fame and greatnesse the Poets grounded that fiction of raising vp the vault of heauen with his shoulders: But whether this *Atlas* euer saw *America*, my reader must giue me leaue to make a doubt. The Ignorance of Navigation in those times, wherein occasion had not brought to light the *char* & *compasse*, together with the huge vastnesse of the *Atlantick Ocean*, will speake my Apologic. 4 The finding of coine graued
with

with the Image and inscription of *Augustus Caesar* in the *American mines*, seemes to me more ridiculous then all the rest: We find the acts and conquests of *Caesar* and *Pompey* in *Europe* and *Asia*, and some parts of *Africk* particularly set downe by the graue writers of that time: We find *Augustus Caesar*, for some petty conquests against barbarous people, emblesoned by the *Poets* of that time to the highest pitch of their inuention: we may obserue the age wherein *Augustus* liued to be the flourish and pride of all the *Romane* learning: and himselfe the Idoll and subject of most of their *Poeticall* flatteries: hauing the happinesse to be inuicted in the empire, in such a time wherein the *Romane* Monarchie hauing been too much wounded with a ciuill dissention, was willing to admire her worst Physician: And can any man be so senselesse to imagine that the discovery of the golde world should passe away clouded in such a flattering age, without any mention? could not so much as the name be registred to reach posterity the way to so rich an Empire? For my owne part I can ascribe this, (if the *Historie* deserue credit) to nothing else but the pride and imposture of the *Spaniards*, whom we obserue in all relations to be a most ingratefull Nation, who admiring nothing but their owne greatnesse, haue requited their best deseruing benefactors with disgrace, and obloquie; struing to raze out their names and memory to whom they owe the greatest glory. *Columbus* was a *Florentine* and no *Spaniard*, and therefore must not deserue so much of *Spain* as his *golden Indies*: otherwise *Augustus Caesar's* image had bin better lost then found, and the Bishop receiued small thanks for his *Perastick* presentation, & That *America* should euer suffer such a deluge as to be lost for so large a time, will sooner bee admitted as a pleasant discourse in table talk, then purchase credit as a likely *History*: it seemeth to be doubted by *Mercator* a great *Geographer* of latter times, inferiour to none before named, whether euer this tract of land were ouerwhelmed with Waters in the generall deluge, which he was induced to beleene out of the disparity of the Soile, Herbes, Beasts, and Inhabitants, with ours, in *Europe* and other parts of the world

world; This opinion I hold not found in Diuinity; yet fecmes it backt with more strength of humane reason, then *Plato's* fable of this imaginary *Atlantick Island*: Much more could I speake of the vncertainty of this first argument, were I not afraid to tire my Reader too much: But this *North-west passage* is a long voyage, and hath bin for a long time sought, and therefore I hope ingenious men will pardon my long discourse.

2 The second reason is taken from a Relation reported by *Gemma Frisius* of three Brothers, who in ancient time passed through this strait into *America*: which accident gaue it the name of *Fretum Trium Fratrum*, by which appellation it is knowne at this day. This argument I take to be more weake then the other, as depending on vncertaine report, Indebted I know not to what approued *History*: But where *History* is vncertaine, reasonable coniecture must challenge precedency: I will heere by way of doubt aske these few questions; whether these three Brothers before mentioned passed through this strait or not? If not, no good Argument can hence bee grounded of such a passage: or if they passed through, I demaund whether they returned to their Country or not, to make a relation: If they returned not, how could such a report with probability be brought home vnto vs? If they returned home: how could such a memorable Action bee forgotten, and not committed to any certaine *History*? especially in such a *Monkish age*, wherein out of ignorance and want of experience, the most petty Inuentions were admired for great matters: The reason as yet makes me to suspend my iudgment of Decision, till I find better.

3 The third reason drawne from *antiquity*, best vrged and husbanded by *Sr Humfry Gilbert* for this *North-west passage*, depends on a certaine Relation of *Indians* in ancient time cast by tempest on the coasts of *Germany*, *Pliny* relates out of a report of *Cornelius Nepos*, who wrote 57 yeares before *CHRIST*, that certaine *Indians* were inforced by violence of tempest vpon the *Germane* coasts, which were afterward presented by the King of *Suenia*, to *Quintus Metellus Celer*,

Celer, then *Proconsul* of *France*, wherevpon *Pliny* inferres in his 2 Booke 66 Chapter, that it is no great wonder, though there be a sea *North*, where there is so much moisture. To confirme this opinion of *Pliny*, and report of *Cornelius Nepos*, they produce the testimony of the excellent Geographer *Dominicus Marinus Niger*, who sheweth how many wayes the *Indian Sea* extendeth it selfe, reciting the same report of certaine *Indians* that were carryed by tempest through the *North-seas* from *India*, vpon the Borders of *Germany*, as they were following their Trade of Merchandize: The argument grounded vpon these Testimonies will stand thus: These fore-named *Indians* arriving on the coasts of *Germany*, must come of necessity either by the *South-east*, *South-west*; *North-east* or *North-west*. The three other coasts seeme altogether improbable, and therefore this opinion of the *North-west* seemes more worthy credit; first, they came not by the *South-east*, because the roughnesse of the Seas, occasioned by stormie windes, and strange currents in those places about *Cape bona Speranza*, seconded by the smallnesse of their Canoes, where in the *Indians* vsually trauailed, seem to stand against su^{ch} a long voyage: 2 They could not well come a long by the shore of *Africke* and so passe into *Europe*, because the windes doe there commonly blow *Easterly* off from the shore; so that the current driving that way would sooner haue carried them *Westerly* vpon some part of *America*, where they should by all likely coniecture, haue perished in that great *Atlantick* Sea, either in that huge and great *Atlantick* Sea either by shipwracke, or want of provision in so small a vessel. 3 If they had overcome all these dangers which wise men would hardly take vp vpon trust: It seemes hard they should not haue first touched vpon the coasts of the *Azores*, *Portugall*, *Spain*, *England* or *Ireland*, before they should arrive at the coasts of *Germany*. 4 For the reason before-named they could not come from the *South-west*, because the current which commeth from the *East*, striketh with such violence on the straites of *Magellane*, running with such swiftnesse into the *South-sea*, or *Mare del Zur*, that a shippe without great burden cannot

cannōt without much difficulty arrive at our *Western Ocean*, through that narrow sea: What then shall we imagine of an *Indian Canoe* managed by such unskillfull mariners? 5. To prove these men to be true *Indians*, and neither *Africans* nor *Americans*, seemes to be warranted; because the Inhabitants of *Africa* & *America* neither had, nor scarce know other kind of Boates then such as beare neither *mastes*, nor *sails*; but such as are only carried along by the shores: except of later times such as have bin instructed by the *Turkes* on the coasts of *Barbarie*, or by the *Spaniards* in *America*: This argument I confesse is wittily spunne out by my renowned country-man *S: Humphry Gilbert*, whose ability seemes to have made a par-ueft out of the stubble. Neuertheless in my conceipt it promiseth in the conclusion more then the premises can well warrant: For first it seemes not to me a matter so cleare out of question whether these ship-wrackt people cast in vpon the coasts of *Germany* were true *Indians*, or not; because so farre as my coniecture leadeth me, being grounded on *Historie*, the name of *Indians* out of the ignorance of those times hath been giuen by the *Romans* to many other forraigne Nations farre distant; especially to the *Aethiops* in *Africa* which beside the testimony of diuerse ancient Historians, too tedious to relate, may seeme probable out of that end of a verse of *Horace*: *Utra Garamantis & Indos*: where for ioynning together two Nations so seperat in place, the former being in *Africa*, the other almost in the farthest verge of *Asia*, he seemed as ignorant of the distance as the people. How should these *Western* Inhabitants know these men to be true *Indians*, whose condition, place and *Language* they neuer understood? 3. Why might not these men come from some of the *Islands* in the *Atlanticke Ocean*? The reason against it, drawne from the current striking with such force on the *streins* of *Mayaguez*, is contradicted by the experience of later Navigators: much more I could speake of this reason; but that I hold it better to cherish a hope of such a passage; then by excepting against these ancient arguments to discourage moderne industrie.

Other probabilities may seeme to be drawne from the discovery,


coueries of later Navigatours since the raigne of *Henry* the seventh, under whose protection *Sebastian Cabot* undertook the discovery of the *North-west* coasts: In which he preuailed as much as the *Alchimists*, who in seeking out the *Philosophers* stone haue often mist of their aime: yet by this meanes inuented many rare and excellent secrets, of vse, and admiration. That *Cabot* the same yeere discovered as much of the *Northerne* parts of *America* as *Columbus* of the *Southerne*, out of my small reading seemes to mee no great question, whence I cannot imagine that King *Philip* of *Spaine* can in this *New-found-world* challenge a greater interest then King *Charles* of great *Brittaine*: a Prince of those incomparable vertues, which may be thought worthier to owne, then the others to pretend to so great a Soueraignty: For the latter voyages & discoveries of *Danis* & *Frobisher* (for ought I see) they promise scarce so much as *Hope*, which oftentimes flatters and deceiues men with her best countenance. But if wee take vp wares vpon trust, some will tell vs of a *Portugall*, who made a voyage through this *Strite Northward*, calling a Promontory within the same after his name *Promontorium Corterialis*; of *Scolmus* a Dane, who passed a great part thereof: but the most probable in my coniecture, is that which *S^r Humfrey Gilbert* reports of one *Saluaterra* a Gentleman of *Victoria* in *Spaine*, who was said to haue passed by chance out of the *West Indies* into *Ireland*, in the yeere of our Lord 1568, who constantly auerred the *North-west* passage from vs to *Cathay* to bee thought nauigable; and farther related in the presence of *S^r Henry Sidney*, then Lord Deputy of *Ireland* (*S^r Humfrey Gilbert* being then present) that a Frier of *Mexico* called *Andrew Vrdanetta*, more then eight yeeres before his arriual, told him that they came from *Mare Del Zur*, through this *Northwest* strait into *Germany*, and shewed *Saluaterra* (being with him at that time in *Mexico*) a *Sea-Chart*, made out of his owne obseruation in that voyage, wherein such a passage was expressed, agreeing with *Ortelius* his *Mappe*: moreouer this Frier told the King of *Portugall* in his returne by that country home-ward, that hauing found such a *North-west* passage, hee

meant shortly to make the same publicke; but the King earnestly intreated him not to discouer this secret to any Nation: for that (said he) if *England* had knowledge and experience of it, it would greatly hinder the King of *Spain* and me. This relation I could willingly credit from the mouth of any other man then a Frier; of whose palpable lyes, and fabulous inuentions in their flattering letters to the Pope, from both the *Indies*, we haue sufficient experience. Neuerthelesse that future ages might not despaire of so worthy an attempt as the discouery of this passage, it hath pleased God to stirre vp the Spirits and industry of two later Nauigatours, *Hudson*, and *S^t Thomas Button*, who haue reniued the forlorne hopes of the former. For the particulars of whose discoueries I know not better where to referre my Reader, then to a curious Mappe not long since set out by our worthy and learned Professour *M^r Briggs*: the arguments I collect from thence are these, expressed in his own words; 1 In the bottome of *Hudson Bay*, where he wintred, the hight of the Tide was but two foot, whereas by the neerenesse of the South sea in *Port Nelson*, it was constantly 15 foot or more. 2 Moreouer in *Port Nelson*, where *S^t Thomas Button* did winter, in 57 degrees he found the Tide constantly, euery twelue houres, to rise 15 foot or more: and that a West wind made the *Nepe Tides* equall with the *Spring Tides*; and the Summer following, about the latitude of 60 degrees hee found a strong race a Tide running sometimes Eastward, sometimes Westward. 3 To shew the land towards the *South-sea*, through which we seeke to open this passage, not to bee so far off as our ordinary Charts seeme to pretend, may be probably auerred, in that *California* heretofore supposed to be a part of the *Western Continent*, is since by a *Spanish* Chart taken by the *Hollanders*, found to bee a great *Iland*; the length of the West shore being about 500 leagues from *Cape Mendocin* to the South Cape thereof, called *Cape S. Lucas*; which may appeare both by the *Spanish* Charts, and by the report of *Francis Gaule*, whereas in the ordinary Charts it is expressed to be 1700 leagues. These Arguments, I confesse, haue swayde my opinion, but not as yet absolutely

solutely freed me from doubt. Three *Queries* I must leaue for the learned to consider, and for the time to decide; 1 whether this relation of Mariners concerning the *Bay of St Thomas Button* and *Hudson* be true or no? no man will (I suppose) censure me as vnmanly for asking such a question, considering how much many Nauigatours, either by their mistakes or their industrious falsities haue deceiued mens credulities; the one is incident to mankind, which out of vncertaine obseruations, or vnnecessary deductions, from thence often drawes an ill consequence; The other, the ordinary policy of discoverers, who lest their Trauailes might bee thought fruitlesse, would at least promise hope in the reuersion. How many relations haue been corrected by experience of later Nauigatours, euery one may iudge. 2 Whether this strong Tide in *Hudsons Bay* comming from the *West*, were from the *South-Sea*, or from the *North*, betwixt the Continent and diuerse Islands by an Inlet, is not a matter as yet cleerely out of doubt. *Terra Del Fuogo* was heretofore supposed to bee a *Continent*, till *Schouten* in his discovery found it to bee an *Iland*, and a large Sea beyond it toward the *South*. Likewise *New-found-land* in all our former Mappes and Globes, expressed as a part of the *Maine of America*, is by later experience found to be an *Iland*: and why may not this happen in the other, that at the entrance into *Hudsons Bay*, the land on the right hand should be clouen into many *Islands*; betwixt which the waters issuing, should be turned in such sort, as it might seeme to proceede from the *West*: sith the Tides taking their beginning from the *Maine Sea*, and continued through some Straite, commonly follow the crooked windings of the Channell. 3 That *California* is an *Iland*, it may (for ought I know) be well warranted: But the euidence drawne from the *Spanish Chart*, seemes rather to cherish hope, then perswade consent. In this which I haue spoken of these worthy mens coniectures, I haue rather expressed my doubts, then my opinion; esteeming notwithstanding that doubt almost & *Heresy*, which should discourage any generous and deseruing spirit from a farther attempt of this *North-west-Passage*.

C H A P. VIII.

Of Sea-Trafficke and Merchandize.

1  F the Internall Affections of the Sea wee haue spoken: It remains now that we treat of the *Externall*: By the Externall I vnderstand that which belongs to Sea-Trafficke, or Nauigation.

2 Sea-Trafficke is a passage by Sea from one Countrey to another.

It is not my purpose in this place exactly to set downe the Art of *Nauigation*; being a matter requiring a speciall Treatise of it selfe: yet because shipping and Nauigation, as Externall or adjacent Accidents, belong to the Sea as the proper subiect; I could not altogether slip them ouer without some mention: In handling of which matter I onely propose to my selfe two things: first, the *Author* and efficient causes of *Sea-oyages* or *Nauigation*; Secondly, the *End* and *Use* thereof: both which wee will knit vp in these two general Theoremes.

1 *Nauigation first taught by Almighty God, was afterward seconded by the industry of famous Men in all ages.*

The first inuention of this excellent art we can ascribe to no other author then God himselfe, who first taught the *Hebrewes* his chosen people, and not the *Egyptians* and *Phenicians*: as some haue falsly imagined: For wee read in *Genesis* that *Noah*

according to Gods precept, made an *Arke* for the preservation of himselfe and other living creatures from the deluge: before which wee cannot learne that there was extant any skill of Navigation: Of which wee haue many reasons and coniectures giuen by ancient writers. 1 Because in those times there was greater need of Citties then shippes; because citties are not made for shippes, but rather shippes, for the vse of citties. 2 Small or little commodity could in those times be reaped from other Countreyes, lying as yet rude and vnpossessed without Inhabitants. 3 Some would haue this to be a reason why God reuealed not this art to the old worldlings: because being ready to perish in the floud, no man might haue meanes to escape or saue himselfe, which without doubt they would haue attempted, had the Art of Nauigation bene knowne amongst them. Whence it is a probable coniecture, that this knowledge of Navigation was discovered first to *Noah* at the time of the *Deluge* whose *Arke* resting afterwards on the mountaines of *Ararat*, gaue a president to other Nations neere bordering, in what manner shippes were to be framed. Whence it came to passe that the first to whom this skill was deriued next to the *Hebrewes* were the *Tyrians* and *Phenicians*, Nations as well for the commodity of the place as Inclination to such businesse more accommodated to Navigation: For *Tyre* was a chiefe *Mart-towne* of *Phenicia* bordering vpon the sea. Which knowledge being deriued from them to other Nations gaue occasion to *Stratus* and *Strabo* to coniecture that they were the first Inuentours of it, being not able through the want of holy writ to ascend higher. From the *Phenicians* was this knowledge deriued to the *Egyptians*, as *Pliny* reports in his 7 Booke and 56 Chapter, when as yet this Art was but rude and altogether vnpolished, as may appeare by the same *Pliny*; who testifies that they then began to saile in a certaine vessell called *Ratis*: which word howsoever it now bee taken generally for any ship, was originally interpreted to be made of Beames ioyned together: In which kind of Ship they are reported to haue passed the *Mediterranean* sea, but especially the *Red-sea*, being set out by

King *Erithra*. Then came this art from the *Egyptians* to the *Grecians* (according to *Pliny* by *Danau*) who perfected this science, and made a ship in a more exact forme then hee had learned amongst the *Phenicians*: whence *Danau* was celebrated the first Author of this inuention: it being a common error amongst all Nations to ascribe the first inuention to him, who was the first discoverer of it to them, being able to deriue it no farther: Yet the *Grecians* being very full of fabulous inuentions haue found out other Authors of this art; for *Strabo* in his 10 booke, giues it to *Mines*: others, as *Diodorus Siculus* in his 6 booke, to *Nepiune*; who is of opinion, that for this cause he was after ward translated into the number of the *Gads*. But this is certaine that amongst all the *Grecians* the *Cretensians* were the first that excelled in this faculty. Whence grew that Prouerbe: *Cretensis nescit Pelagus*: as who should say nothing could be imagined more absurd and ridiculous then that a man should be borne in *Creer* and haue no skill in Navigation. Others ascribe the first knowledge of making ships to *Dadalus*, a rare workman in mechanickall occupations: From the *Grecians* afterwards was this trade communicated to the *Italians*, amongst whom the *Genouensians* and *Venetians* most excelled. Of the *Venetians* skill in this matter, we read no other argument then their great riches & magnificent power, especially by the sea, which hath continued vnto this day: whereof no other cause can be thought on, next vnto Gods providence, then their industrie in Sea-voyages. After these arose the *Portugalls*, who vnder the conduct and direction of *Columbus* an Italian, discovered *America* called the new-world; and gaue example and excitement to many other Nations to aduenture farther. Amongst which (by the testimony of out-landish people) no Nation hath waded farther then the *English*, who vnder *Drake* and *Candish* haue compassed about the world and left an eternall Trophie of their immortall fame vnto posterity. Yet can wee not here defraud the Low-country men of their due commendation, especially the *Hollanders*, *Flemmings*, and *Sealanders*; who by their riches acquired by navigation and extraordinary power at Sea, haue kept in despite of the

the vsurping *Spaniard* these Prouinces, farre richer then at the beginning of their warres, and deserued that saying which was giuen to one of the *Grecians* citties, by the Oracle; *That it was guarded not with stones, but with wooden walls.* Thus much may suffice for the Authours and first Inuentours of Navigation. Wee are now to speake something of the ends and vses of it, which may in generall bee referred either to profit or pleasure: Both which are againe spread into many Branches; the most of which wee shall comprize in this following Theoreme.

2 *Navigation is very necessary as well for the increase of Knowledge as Riches.*

Necessity is vsually taken two wayes; either for an absolute need, without the which a thing cannot bee: or Comparatiuely for a conueniency, without the which a thing cannot well bee: In both senses I may call Navigation necessary for a mans life: for to deferre the later, whereof lesse doubt is made; it is certaine that many places are so poore, barren, and indigent of all succour and reliefe, that they cannot maintaine a populous Nation without forraigne commerce and trafficke; especially in these dayes, where the multitude of men is increased to so great abundance: for the later, many arguments may bee produced to proue the conueniency of Navigation, which no man of any iudicious insight can deny to bee most strong and forcible. The first argument may bee drawne from the Authours and Inuentours of it, whereof wee haue spoken in the former proposition: for first (as wee haue shewed) it was prescribed by God himselfe, who neuer taught mankind any thing idle or vnecessary. It was embraced and cherished by many Nations euen till this day, which no doubt had long since beene lost, had not vse and profit seconded the Inuention. Neither is it probable that Almighty God should create that vaste Masse of Water, that it should bee an Element for fishes to liue onely, or that (as some guesse) it should somewhat mitigate the extremity and drouth of the Sunnes heat: But that men should by this means haue an ea-

sic and ready way to communicate and traffick one with the
 other; which may appeare as well by many Testimonies out
 of the Sacred Scripture; namely *Psalm 104. v. 23. Eph 1. 6.*
Psalm 104. v. 23. as also by the example of King *Salomon*, the wisest of
 all Kings, who by this meanes got great store of gold from *O-*
phir to build the Temple, as will appeare in *1 Kings* and the 9
 Chapter. The second reason therefore may bee drawne from
 the exercise of Merchandize, and transportation of commodi-
 ties, which cannot bee administered without Sea-voyages: first
 because greater store of Merchandize may be carried in a ship
 then in a Cart, Waggon, or any other Instrument ordinarily in
 vse. Secondly, because in ships greater variety of wares may
 bee brought from diuerse places, to which a Waggon cannot
 without great difficulty approach, or not at all. Thirdly, be-
 cause wares and such commodities cannot so quickly bee con-
 uayed in the land from places farre distant, as on the sea: nor
 with so little cost and charges. The commodities conuayed
 from one Countrey to another are chiefly three; stufes and
 other matters necessary for apparell, victuals and food, Phy-
 sicall Druggs, all which no man will deny to be most profita-
 ble for the vse of mankind. Moreouer it is not to bee imagined
 that nature produceth such commodities onely for the priuat
 behoofe of some one country wherein they grow: Fifth, because
 such commodities in some countries are found in such abun-
 dance, that the same place seemes not to need them: And na-
 ture were vaine, if the vse were not required. *India mittit E-*
bux, molles sua thura Sabæ. Secondly, because other Nations
 altogether want such things which abound in other coun-
 treyes: without the which notwithstanding they cannot well
 live. A fourth reason may bee drawne from the promotion of
 Religion & sciences, which cannot well be atcheiued without
 Sea-voyages or Navigation. For the former wee need goe no
 farther then the holy Scripture which giues large testimony of
 such voyages: In the old Testament as well as in the new, we
 haue recommended to all posterity the industrie of the Queen
 of *Saba*, who is said to haue come from the vttermoſt parts of
 the Earth to heare the wisdom of *Salomon*: And how should
 the

the Gospell of Christ haue bene diuulged to diuerse Nations, had not the Apostles dispersed themselves, and passed the Sea in ships, to conuay their sacred message to diuerse Nations and Kingdomes? neither is it lesse euident in the propagation of Learning and humane Sciences: First, out of the example of many and famous worthy Philosophers, who trauielled far to conuerse with learned men of other Nations, to enrich their mindes with knowledge. Secondly, out of the first propagation of Learning into our parts; which wee shall finde (as it were) foot by foot to follow Nauigation. Hence wee see that from the *Hebrewes* and *Chaldees* it was deriued to the *Tyrrians*; from them to the *Egyptians*; so to the *Romans*, and thence to most parts of *Europe*. A fourth reason may bee taken from the necessity of transporting Colonies into forraine countreyes: for as after the vniuersall *Deluge* of the world, the people daily encreasing, were enforced in tract of time to disperse themselves into diuerse Countreyes: so euery Countrey left to it selfe, and not much molested with famine, or deuoured by warres, will at length grow too populous; vnable to sustaine its owne weight, and relieue its owne Inhabitants. Whence it hath been a policy practised by most Kings & States in such cases, to make forrayne expeditions, and send forth Colonies into other Countreyes lesse peopled, to disburden their owne of such encombrances: as we see the Kings of *Spaine* to haue sent many into the *West-Indies*; and we at this day discharge many *Idlers* into *Virginia* and the *Bermudas*. Here also is the Art of Nauigation vsfull, without which, the Seas could not be passed, nor forraine Countreyes knowne. Fifthly, Nauigation seemes to bee of greater importance for the defence of a Countrey against forraine Nations; because Sea-fights are lesse dangerous and inconuenient to the Land, then Land-fights. All these arguments haue their force and life to proue the profit of this excellent Science. Many arguments may bee drawne to proue the vse of it for pleasure and delectation; which being well vsed, hath his place amongst other of Gods especiall blessings. This delight will first shew it selfe in the mutual commerce and society with other Nations: Such a


man (as *Aristotle* affirms) is by nature inclined to mutuall society, and cannot reape greater pleasure then in such conjunctions: And as one Man with another findes solace; so one Nation with another: especially in the variety of sundry *manners, customes, rites, and dispositions*. Secondly, in the contemplation of wise *Nature*, who hath endowed diuerse countreyes with diuers *Minerals, Plants, Beasts*, and such commodities; then which variety nothing can be more delectable to an ingenious vnderstanding. To all which we may add as a Corollary, the *Honour* which hath been giuen to Navigation by Princes and States, as well of former as later yeeres. In ancient times wee read that *Ptolomy Philadelphus*, that learned King of *Egypt*, who furnished himselfe with so rich a *Library*: 277 yeeres before Christs Incarnation, gaue great incouragement to Navigation, and maintained the passage through *Sinus Arabicus*, or the *Red-Sea*, by which the commodities of *India* and *Arabia* were brought to *Alexandria*, and from thence dispersed through diuerse places of *Europe, Asia*, and *Africa*: This was after ward seconded and cherished by the *Romans*; at which time *Egypt* was made subiect to their dominion: But the *Roman* Empire being afterwards rent in pieces by the *Gothes, Vandals, Lombards*, and *Saracens*, all trafficke betwixt nations began a while to cease; till such time as the inconuenience being knowne, a new *Mart* was set vp at *Campsa* in *Taurica Chersonesus*, belonging at that time to the *Genois*: Thence was it deriued to *Trebizond*, and afterwards to *Samerchand*, where the *Indian, Turkish, &c Persian* Merchants were wont to trade with the *Venetians*. This *Art* was afterwards set vp and reuiued by the *Sultans* of *Egypt*, through the passage of the *Red-Sea*, till such time as it was in a manner taken away by the *Portugals, Spaniards, English, and Dutch*; who haue found out for themselves a better way by the *Cape of good Hope*, to the *East Indies*, and by this means much abated the Trafficke of *Alexandria*, and the wealth of the *Venetians*. Neither in this Age of ours haue there wanted great Potentates, who haue not onely endowed this *Trade* with great and ample priuiledges; but also themselves practised

such

such commerce, as well for the benefit of their Commonwealth, as the increase of their particular estate. Two memorable examples we haue, in *Henry the third, King of England*, and *Laurence de Medices Duke of Florence*, whereof the former gaue many and large priuiledges to all the *Hance Townes* in his Kingdomes, which were in Number about 27: The other himselfe for his owne priuate commodity exercised the Trade of Merchandize: yet was this man most ingenious, and a great louer of learned *Men*.

C. H. A P. IX.

*Of Pedography, Riuers, Lakes, and
Fountaines in the Earth.*

1  E haue formerly treated of *Hydrographie*, or the description of the Water; now are we (by Gods assistance) to proceede on to *Pedographie*, which is a description of the *Firme Earth*, or *Dry-Land*.

2 The *Land* is a space contained in the superficies of Earth, distinguished from the Water.

The Earth in this place is not taken as in the former part of *Geographie* for the whole *Terrestriall Spheare*, composed of Earth and Water: Neither yet as it is vsually taken in *Naturall Philosophy* for an Absolute *Elementary* body, whose causes and affections are to bee searched out; but *Topographically* for a place or habitable space on the *dry-land*; This *dry-land* distinguished

guished from the Water by its Firmenesse and Constancy, being not subiect as the Water to motion and inconstancy, was therefore (if we believe the Poet) called *Vesta*, according to that verse, *Stat vix terra sua, vi stando Vesta vocatur*. Neither wants this fable of *Vesta* a sufficient morall. First, because *Vesta* was faigned to bee a keeper and protectour of their houses, which may very well agree to the Earth: which not only sustaines and beares vp all buildings and houses; but also affords all commodities and fruits wherewith households are maintained. Secondly, *Vesta* was faigned to be the Goddesse to whom the first fruits were offered in sacrifice: which may well square with the nature of the Earth, from which all fruits are originally deriued; and therefore (as it were of due) ought all first fruits to bee consecrated to her altar. Two other Parallels betwixt the Goddesse *Vesta* are added by *Natalis Comes*: First, because *Plutarch* sheweth in his *Symposiacks*, that the Tables of the Ancients, dedicated to *Vesta*, were made round in forme and fashion of the Earth: Secondly, because the seat of *Vesta* was imagined to bee in the liquid *Aire* immouable, and not subiect to motion: which well agrees with the common conceiued opinion of the Earth. But these two rather expresse the nature of the whole Terrestrial Spheare, then of the land diuided from the Waters: This description of the dry-land separated from the Waters, we haue termed *Pedographie* because the Greeke *πῆδος*, commonly deriued from *πῆς*, a foote, signifies as much as a firme place, whereon men may haue sure footing, to which is consonant the Hebrew word *רָחַל*, which seemes most probably deriued from *רָחַל*, which signifies as much as *Terere*, to weare out or waste: because the Earth is dayly troden and worne with our feet. The proprieties of the Earth appertaining to a *Cosmographer*, are many and various; wherefore to auoid confusion; wee haue diuided them into these heads.

- 3 The Adiuncts of a Place in the Land are either *Naturall* or *Ciuill*: The *Naturall* are
such

such as are inbred in the Earth.

4 The Naturall may bee againe diuided into *Perpetuall*, or *Casuall*. *Perpetuall* are such as alwayes, or most ordinarily continue the same.

5 The *Perpetuall* proprieties are againe twofold; either *Absolute*, or *Comparatiue*. The *Absolute* I call such as agree to the Land without any respect to the Sea.

6 Of the former sort are such as belong to the Figurature of the Soile, wherein three things are most remarkable: 1. *Riuers*, *Fountaines*, and *Lakes*. 2. *Mountaines*, *Valleyes*, and *plaines*. 3. *Woods*, and *Cham-pian Countreyes*.

7 A *Riuer* is a perpetuall courſe of water from a certaine head or fountaine running from an higher to a lower place on the earth.

Riuers are by ſome Geographers more curiouſly diſtinguiſhed into 2 ſorts: whereof the firſt are ſetled or ſtayed *Riuers*, which ſlide away with a more equall and vniforme courſe: The later are called *Torrents* or ſtickle waters, which are carried with a far greater violence. In a *Riuer* three things are chiefly remarkable: Firſt the *Fountaine* or *Spring*: ſecondly *Whirle-pooles*: Thirdly the *Mouth* of it. The ſpring is the place, where at firſt the water ſenſibly breakes out of the Earth:

Earth: As *Nilus* in *Affricke* is thought to haue his first head at the mountaines of the *Moone*. A *Whirlepoole* is a place in a Riuer, where the water falling into a Deep trench, is whirled & turned round. The *Mouth* is the place where any Riuer finds a passage out, either into the sea, or into another greater Riuer; which in *latine* is termed *ostium* or a gate: Whence they call *Septem ostia Nili*: which are seuen mouths, by which it falls into the *Mediterranean*. This gaue the name to many Citties and Townes in *England* as *Plimmouth*, *Dartmouth*, *Portsmouth*, *Armouth*, with many others. Now for as much as all water is by nature heavy, and therefore couets the lowest place; The course of all Riuers must needs bee from a higher to a lower place: whence we may guess the hight of lands. For it is necessary that for euery mile wherein the water glides forward on the earth, there be made an allowance of 2 foote at least in the decliuitie of the ground. For although water will slide away at any inequality, yet could not the water bee wholesome, and retain any reasonable swiftnesse of motion without this allowance. Hence we may probably find out the huge hight of the *Alpes* about all the places in *Europe*: because out of them spring foure great Riuers, which runne foure wayes; whereof the two greatest are the *Danow* (which receiues into it 60 Nauigable riuers and so disburthens it selfe into the *Euxine Sea* far remote) and the *Rhene*. Of Lakes and Riuers many memorable matters may be spoken: all which we will reduce to these heads. 1 Their *Generation* and first originall: 2 Their *Appearance*: 3 Their *Place* in the earth: 4 Their *Vertues* and effects; all which we will comprehend in these Theoremes following.

1 All Riuers haue their first originall from the sea the mother of Riuers.

The originall of fountaines and Riuers on the earth is a matter of great difficulty, and for ought I know, not yet found out of our greatest *Philosophers*; yet being willing to goe as farre as I can, I will glance at probabilities, and first set downe other mens opinions. Some haue beene of opinion that

that in the bowels of the earth are hid certaine vast concavities and cauerues, which receiuing into them a great quantity of raine-Water, haue giuen originall to *Lakes* and *Fountaines*. Hence they giue the reason why these fountaines are perpetual; Because the raine-water receiued into these cauerues being extraordinary great, is sufficient to nourish such springs of water vntill the next winter; whence comes a new supply of more raine. These Riueres (say they) in the summer decrease, and sometime are dry, because of the defect of water, when the place is not great enough to receiue sufficient water for the whole yeere. This opinion seemeth grounded on these reasons: First, because wee find by experience, that Riueres and fountaines are greater and larger in *Summer* then in *Winter*. Secondly, because where there is lesse Raine, fewer or no Riueres are seene. As in the Desarts of *Ethiopia* and *Africke* few or no Riueres are found: But in *Germany*, *France*, *Brittany*, and *Italy* many Riueres shew themselves; because they abound in the moisture of the *Aire* and much fall of Raine. Thirdly, amongst vs (wee see by experience) in a hot and dry *Summer* they are much decreased from their ordinary greatnesse, or altogether dried vp; which is a great probability that their originall is from raine. This opinion if it bee onely vnderstood of some Riueres, may be probable; because some currents out of doubt take their originall from great showers or snowes, as at the foot of the *Alpes* and other such places, where the snow daily melts and feeds them: but if it be generally vnderstood of all Riueres, it is manifestly false as may appeare by these reasons. First, because the Earth no where drinks vp the raine farther then ten foot deep in the soile; for the higher superficies of the earth is either dry and so easily drinks vp and consumes the Water within that space; or else being already moist, it receiues it not at all, but expells it by Riueres and channells: Secondly, some mountaines not couered with earth, but consisting of hard rocke, notwithstanding send forth great store of *springs* and *fountaines*, which water could not bee receiued in, through a hard rocky substance. Thirdly, because in very dry places certaine pits being digged downe in-

to the ground a hundred or three hundred foot deep, will discover many great streames of Water, which could not be from the receipt of Raine. Fourthly, it cannot be imagined that so much raine could in a winter fall into one place, besides that which the drouth of the earth consumes, to nourish so mighty and great Rivers in the Earth, as are Rivers running in a perpetuall course. Fiftly, all Rivers almost take their originall from some mountaines or other; as *Danubius* from the *Alpes*, and *Nilus* from the mountaines of the *Moons* in *Africke*; Which places being extraordinary high, are more vnapt to receiue water, then lower places of the earth. To the reasons that they all edge for their opinions, it is not hard to answer. That rivers should be greater in winter then in the summer, the cause may be better giuen; Because more moisture of the Air falls into the brinke from externall Raine or snow in winter then in summer, and the ground being moister, is able to drinke lesse then at other times: which is also the reason why in hotter and dry Countreys there is not such plenty of Rivers: for we deny not, but fountaines may sometimes be increased and sometimes diminished by addition of raine-water: but that any such vast concavity should be vnder ground, as the receptacle of so much raine, and should nourish so many and so great currents. The second opinion is of those who thinke that the originall of all rivers and fountaines is from the Sea: Which conceit hath beene strongly fortified by many Fathers of the Church, and graue Diuines of later time; which opinion is chiefly grounded vpon these reasons: First because it seemes a most incredible matter, that so much vaporious matter should be engendred vnder the earth, to feed such a perpetuall course of water: Secondly, if all Rivers should not be deriued from the sea, no reason could bee giuen, why so many rivers dayly emptying themselues into the sea, the sea should not encrease, but continue in the same quantity. Thirdly, to this purpose they vrge the place of *Eccles. 1. All rivers runne into the sea, and yet the sea is not full: To the place whence they came they returne, that they may flow againe.* But this opinion seemes to bee shaken with a great difficulty. For it is a
hard

hard matter to conceiue how the water of the sea being by nature heauy, & lower then the superficies of the earth (as we haue demonstrated) should ascend into high mountaines; out of which we find springs of water oftentimes to arise: for either it must ascend *Naturally* or by *Violence*: not naturally for the foresaid cause; because it is a heauy body: If violently, they must assigne some externall Agent, which enforceth it to this violence. This difficulty diuerse Authors haue laboured diuerse waies to salue: Some amongst whom the chiefe was *Theoderet*, haue fled to a supernaturall cause in Gods providence; as though the water in it's own nature heauy, should be notwithstanding enforced to the topps of the mountaines; But this opinion seemes very improbable; because, although we cannot deny Gods miraculous and extraordinary working in some things; yet all men haue supposed this to be confin'd within the bounds of nature: And very strange it were to imagine that almighty God in the first institution of nature should impose a perpetuall violence vpon nature. Others, as *Basil*, haue thought that the sea-water was driuen vpwards towards the topps of mountaines by reason of certaine spirits encloused in it: *Mare (as he saith) fluitans & permeans per cuniculos fistulares & angustos, mox ubi obliqua aut certe recta in sublime surrectis excursibus se occupatum deprehenderit ab agitante compulsus spiritu, superficie terra vi disrupta erumpit atq; foras emicat*; The same opinion almost in euery respect is ascribed to *Plato* in *Phedone*, and *Pliny* 2 booke. 65 chap. *Quo (inquit) spiritus, actu & terra pondere expressa siphonum modo emicant, tantum a periculo decidendi abest ut in summa quoq; et altissima exiliat: Qua ratione manifestum est, quare tot fluminum quotidiano accessu maria non crescant*. But this exposition will hardly satisfy him who desires to search farther then obscurity of words: For first by admitting spirits as mouers of the waters, they seeme to fall into a *Platonick* opinion before examined of vs concerning the heat of the sea-water. Secondly, I would demaund whether such spirits in the water to which they ascribe this motion, be *Naturall* Agents or *Supernaturall*; or *Violent*; They cannot be naturall Agents: For

a (much as they are supposed to driue and enforce the water against his owne nature. For by nature (as all men know) it is apt to descend; whereas here it is supposed to ascend by reason of such spirits. They cannot bee violent agents because they bee perpetuall; whereas no violent thing can be perpetuall. *Thomas Aquinas* being desirous to shew, how much fountaines could ascend out of the sea-water varies in opinion from the former, and imagines that the fountaines and River-water is drawne vpwards through the force of Celestiall bodies, for the common good; to wit that it might water as well the mettalls in the bowells of the earth, as giue moisture and nourishment to *Plants*, and liuing creatures, dwelling thereon. And this motion (saith he) although it be against the particular nature of the water, is not altogether violent: because elementary bodies are bound by a certaine law to obey and subiect themselves to the heavenly; so that motions impressed by them, are not enforced on them by violence. For albeit in some sort it thwart the phisicall disposition; yet haue all creatures an obedientiall aptnesse (as they terme it) to submit themselves to the superiour. But this opinion of *Thomas Aquinas* (in my conceit) seemes lesse sound then the former: For first *Thomas* had no need at all of these shifts, holding some of his other grounds: For in another place, comparing the height of the sea and land one with the other, he firmly maintaines that the sea is aboue the land, and that it is bounded and restrayned from ouerflowing the dry land, by the immediate power of the Creator: If this be graunted, what need there any ascent or drawing vp of the water, by any externall power of the heavenly bodies: sith the remitting of this restraint of waters in some places, were sufficient to cause such *springs* and *riuers* in the earth: Secondly, his opinion cannot stand without manifest contradiction of himselfe; for how can the water, being of his owne nature heauy, be drawne vpward without violence and thwarting of nature. And whereas he alleadges for himselfe an obedientiall aptnesse in the elementary bodies to obey the superiour, he shall find very little helpe to maintaine his part. For this obedientiall inclination must be either according

ding to the nature of the water, or opposite vnto it, or at least the one must be subordinate vnto the other: That it is according to the nature of the water, he himselve disclaimes and experience refutes; because it naturally *descends*, not *ascends*: if it be opposite (as indeed it must needes be) he contradicts himselve: If the *Physicall* and *obedientiall* inclination be *subordinate* the one to the other, I vrge, that subordinate causes can produce no other then subordinate effects; for asmuch as the causes and the effects are measured and proportioned the one by the other. But wee plainly see that the motions of ascent or descent are diametrically opposed, and contrary the one to the other; so that they cannot otherwise proceed, then from opposite and contrary causes. Secondly this obedientiall aptnesse, is commonly vnderstood of a creature, in respect of his Creator, in whose hand it is, as to create all things of nothing, so to reduce all things againe into nothing. But this although it be aboue nature, yet no way contradicts nature: and easier it is to be imagined, that the *Creator* should annihilate any *Creature*, then letting it remaine in his owne Nature, giue it a motion against nature: Moreover if we duly consider nature in her course, we shall find that the *lower & elementall* Bodies onely concurre to the conseruation of the *whole*, and of one another, by following their owne priuate inclination: for the whole is nothing else then an orderly concent and harmony of all the parts; from whose mutuell cooperation, it receiues his perfection; so that where any part failes in his owne office, the whole must needs sustain dammage. Thirdly, it will hardly be resolved by any of this opinion, by what meanes or instruments the heavenly or superiour Bodies can haue such operative power ouer the water, as to lift it vpward from his owne Center: for neither can this thing be performed by *motion*, *light*, or any *Influence*, which are the three meanes of operation of celestiall Bodies on elementary: I will not stand to proue every particular in this matter: But onely would haue my aduerfary to answer, and giue an instance and speciality. Another opinion there is of *Aristotle*, followed by all *Peripateticks*, who in his first booke of *Meteors*, and 13 Chapter,

goes about to prove and maintaine, that all *Springs* and *Wells* in the land are produced and generated in the bowells of the Earth by any vapours resolved into water: which opinion he labours to strengthen in this manner. It is certain (saith he) that the Earth hath within it much aire; because *Nature* will no-where admit a *vacuity*. But the Earth hath not onely many open, but a great many secret holes and concavities which cannot otherwise be filled then with aire. Moreover a great part of the Earth, and other vapours therein contained, and stirred up by the force of the Starres, are converted into Aire; and that aswell the Aire included in the bowells of the Earth, as vapours there also bred, are perpetually converted into water: This reason may seeme to perswade, because it follows of necessity, that the coldnesse of the Earth expelling their heat, they should harden & condensate, & be disposed at last to the generation of water: whence also the cause is given of the generation of water in the middle Region of the Aire, although it be not alwaies thence bred: aswell for other causes, as for that the Aire by the heat of the Sunne is sometimes too hot, and the vapours are too much attenuated and rarified: so that the matter of Raine cannot be alwaies supplied. This would *Aristotle* have to bee the originall of all *Springs* and *Fountaines*; So that the water should first distill as it were drop by drop, out of this vapourous matter: and this moist matter so collected and drawne together, should afterwards breake forth out of the ground, and so cause such fountaines. Some reasons are also produced to prove this assertion; for (say the *Authors* of this opinion) If the *Springs* and *Rivers* should proceed from any other cause, then they should take their beginning from *Raine-water*, which is before refused; or from the Sea by certain secret passages, which opinion seemes too weake to endure examination: First, this seemes an argument, that the *Sea-water* is commonly *Salt* but the water of *Springs* and *Rivers* is for the most *sweet* and *fresh*; and therefore such *Springs* are not derived from the Sea: Secondly, because we never find the Sea to be emptied, which must needes be, if it should give beginnings to all such currents of water

in the Earth; Thirdly (we haue already shewed) that the *superficies* of the Earth is higher then the Water; so that it cannot be conceiued how riuers should be deriued from the Sea. To this opinion, howsoeuer seeming probable, and supported with the name and authority of so great a *Philosopher*, I dare not wholly assent; forasmuch as it thwarts the Testimony of holy *Scripture*, and cannot otherwise stand with reason: because it cannot well be imagined how so many vapours, and so continually, should be ingendred in the bowels of the earth, to nourish so many and so great currents, as we see springing out of the Earth: for a very great quantity or portion of *Aire* being condensed and made Water, will become but as a little drop: The *Aire*, according to *Aristotles* grounds being by a *Tenne-fold* proportion thinner then the Water. Moreouer the *Aire* in these places seated in the *superficies* of the Earth, and higher then other places, and by consequent neerer the Sun, should rather be *rarified* and *thickned*; because heat is the greatest cause of rarefaction, as we shall shew hereafter: for the reasons alleaged for these opinions, they are drawne only from the weaknes of their assertion, which hold that *Fountaines* are deriued either from *Raine water*, or from the *Sea*: both which wee haue examined briefly, and whereof wee shall speake hereafter. The Schoole of *Comibra*, not vtterly reiecting all the former opinions, haue vndertake to forgoe an opinion (as it were) partaking of all, pretending to say something more, when indeed they produce nothing besides the former. Their assertion they haue set downe, in eight propositions, which I will faithfully set downe, and then censure. The first is that in *subterranean* places vnder the superficies of the earth, is hid a great quantity of water, distinguished into *Riuers*, *Ponds*, and *Lakes*. This they proue from the daily experiment of such as diggs diuerse wells and deepe trenches in the Earth; Who many times vnder the Earth, find not only many riuers and ponds, but many times happen vpon so great abundance of Water, that they can neither find the bottome or bounds thereof. To this they add an experiment of *Philip* and *Macedon* recorded by *Alepiathorus*

who caused many men expert in digging of mettalls, to be let
downe into an old and forsaken mine to search out the veines
of mettalls, to see whether the couetousnesse of antiquity had
left any thing to posterity. These men vsing great lights are
said to haue found nothing there, but great and vast riuers
and great receptacles of waters. This they also labour to con-
firme by many and suddaine eruptions and breaking out of
waters out of the earth, whereof we shall haue occasion to
speake more hereafter. This first position, how soeuer in it
seife true enough, seemes litle to the purpose; but we will pro-
ceed to the second, which is this: That when God in the
third day of the Creation seperated the waters into one place,
and hid it in the cauerns and secret receptacles of the earth;
at the same time dispersed into diuerse parts of the earth, a
great quantity of water by diuerse occult passages and chan-
nels, whence comes that great masse of waters vnder the
earth, which is before mentioned. This they seeme to per-
swade by reason: for (say they) as the wise *Architect* of all for
mans sake, and the rest of liuing creatures for the vse of man,
hath discovered the dry land, by restrayning all the waters in-
to one place: so it was most necessary, that he should in-
wardly water the earth, by which *stones, mettalls, mineralls, &c*
other such things in the bowells of the Earth, should in time
grow and increase. Also that some water should from hence
breake vp out of the Earth, for diuerse causes hereafter spe-
cified. Finally as *Philo-Iudaus* affirms, for the continuation
of the parts of the earth, which otherwise might by drouth
be seperated and diuided. The third proposition grounded on
the two former is this: That many riuers and fountaines in
diuerse places by Gods decree arise out of the earth, by quan-
tities of waters hid in the cauerns of the earth, which they
proue by reasons drawne from the vtility of such fountaines
and riuers, springing out of the earth. Fourthly they defend,
that all fountaines and currents were not so made and appoin-
ted in the first *Creation*; because Histories & experience teach
vs, that many haue broken out of the ground afterwards;
whereof we shall haue occasion to speake hereafter. Fifthly
they

they affirme, that if the opinion of *Aristotle* be vnderstood of all fountaines and floods; it cannot be approued; forasmuch as it seemes sufficiently declared in the third opinion, how such riuers might be generated without such vapours; as also becaute many arguments and places of *holy Scriptures*, seeme to proue the contrary. As also the foure Riuers of *Paradise* created in the beginning of the world, cannot be guessed to draw their originall from such vapours, as *Aristotle* imagines; to which accord many ancient *Fathers* vpon these places recited in that opinion, whereas all riuers are thought to fetch their originall from the sea. Sixtly for the credit of their master *Aristotle*, they are constrained to auerre that although his opinion cannot be verified of all riuers and fountaines of the earth, yet if it be restrayned to some such perpetuall currents, it may haue probability. Forasmuch as we are to beleue that many such large cauerns and holes are hid vnder the earth, in which no small quantity of vapours may be ingedred. This probability is greater in those riuers which are lesser in quantity then the greater, for the reasons before shewed. Seuenthly they affirme that it is absolutely to be beleued; that not only great riuers and currents are deriued from subterranean waters, which haue originall from the sea; but also lesse fountaines and springs for the most part, challenge the same beginning: whence they labour to proue by this reason, that in very few places of the earth there is found so perpetuall and apt disposition of vapours vnder the ground as to nourish so many and so great currents of water. Eightly (say they) it cannot be denied, but that Waters aswell proceeding from raine, as that which is generated of vapours in the cauerns of the earth, sometimes may flow into fountaines and riuers: What concernes Torrents bred of raine, they haue recourse to the reasons of the first opinion; for others they make it also probable; because we see by experience that *Vapours* and *Aire* compassed about with earth, are by reason of the cold enuironing it, turned into water. This is indeed the opinion of those subtil *Iesuits* of *Conimbra*, wherein although they giue a flourish, as if they would defend their

6

7

8

master *Aristotle*, on whom they comment; yet meane they
 nothing lesse; but indeed warily sticke to the other of the
Divines and *ancient Fathers* of the Church; touching the de-
 rivation of all torrents from the sea. Which opinion, how soe-
 ver in it selfe most probable; they know not how to manage
 and defend against opposition. For whereas they suppose
 that in the first separation of the *sea* from the *dry-land*, a great
 quantity of water was dispersed into diuerse hollow places &
 cauerns of the earth, from whence *Riuers* are deriued and
 made: they haue not in any probable manner expressed,
 how this water should perpetually flow, and feed so many &
 great currents. For first, I would aske of these learned fathers,
 whether the water inclosed in the bowells of the earth,
 whence these springs are fed, be *higher* or *lower* then the
 fountaines arising out of them. If it be higher; whether the
Riuers are continually nourished on the old store, or a new
 supply be daily made. That so great riuers should bee main-
 tained so many thousand yeares out of the old prouision, is
 most improbable, because the mountaines out of which such
 springs arise, cannot be capable of so great a continuaty: nei-
 ther can it otherwise be imagined, but that many great riuers
 since the beginning, had either bin absolutely dried vp, or at
 least diminished in their quantity, their *Cisterns* being daily
 more and more emptied out into their channells. If they
 graunt that of this water, a fresh supply be made; it must be
 either from the *sea* or from *vapours* in the earth. It cannot bee
 from the *sea*; because (as wee haue proued before) the *sea* is
 lower then the fountaines, where springs breake out of the
 Earth; forasmuch as we see them runne to the sea from their
 fountaines, as from a *higher* to a *lower* place. That this sup-
 ply of water in the depth of the earth should bee made by *va-
 pours*, it is also improbable in their opinion; who cannot i-
 magine so many ingendred in one place, as to feed so great
 currents; as also because many riuers were apparant in the first
creation, as the future great currents of *Paradise*. This obiection
 hath so farre driven the *Iesuits* to their shifts, as that they
 haue bin enforced to haue recourse to the opinion of *Thomas*
Aquinas,

Aquinas, who dreames that the waters are enforced vppwards by the influence of the *heavens*; which they a litle before cast by, and we haue before sufficiently refuted. And wheress in the subsequent clause, they labour to salve this place of *Be- clestiaſtes*: That all Rivers come from the sea, and returne thither againe; They are constrained to leaue their old grounds, and runne backe to *Aristotle*, who holds that all riuers had their originall from *vapours*, drawne vp by the sunne; where- of the sea is the chiefe mother. It will bee expected at least that we should disclose our owne opinion; having censured the former: which we will briefly doe as neere as probability can lead vs, submitting also to those which are more iudicious. First therefore, we will suppose as probable: that the earth is in a manner compassed round about with water; for howsoe- uer the places more eminent, and separated for our habitati- on, be dry land, yet not farre vnder the superficies of the earth, whereon we tread, is the earth sprinkled round with water, for which we may draw an argument; as well frō the *Porous* and *spongy* nature of the *Earth*, which is apt to drinke in the water of the sea, in the same hight; (because it is the nature of the water, to diffuse it selfe abroad) as also from experi- ence of *Miners* and such as digg deepe into the earth, who in most parts find water, & this water so enuironing the earth, were it left to it's own naturall situation, without an exter- nall Agent, would lift his superficies no higher, then the su- perficies of the sea; because being as one with the sea, it will challenge the same *Sphericall* superficies. Now to know how the water thus naturally settled, is notwithstanding lift- ed vp higher to become the source of Springs, we must vn- derstand, that it comes to passe not onely by the heat of the *sunne* and *ſtarrs*, piercing farre vnder the superficies of the earth, according to the circle, we haue allotted to the water. But also to *subterranean fires* hid in the bowells of the earth, in many places: which are caused by *sulphureous* matter set on fire by the sunne, or some other accident: whether this *sulphu- reous* matter be pure *Brimstone*, or *Bitumen*, or a mine of *ſea- coale*, as some haue thought of our *Bathes* in *England*; I will

will not curiously here dispute, being of it selfe too large a subject for me in this place to handle. This *bear* may be conceiued to concur to the production of fountaines a manner of waies: First, by drawing vp diuerse moist *vapours*; which by reason of the *thicknesse* and solidity of the earth, being not presently euaporated out of the superficies of the earth, are enforced to disperse themselves through diuerse crooked passages, where condensated by cold distilling againe into drops of water, they breake out through some places of the earth, and so become a fountaine. A second way which may also seeme probable, is that the *Heat* peircing the *Subterranean Water*, though not able to dissolue much of it into vapours for the solidity of the earth, may notwithstanding through his heat, *Rarise* and attenuate these waters. These waters then rarified, must needs seeke a greater place, wherein they may be contained: sith *Raresfaction* is nothing else but the extension of a body to a greater place then before it occupied: Hence is the Water enforced to enlarge his limits: This enlargement or the place cannot be downward towards the Center; because all that place was supposed to be filled vp as farre as the Earth could drinke it. Wherefore it must needs extend it's limits *sidewise*, or *upwards*: By the former of which it may find a passage to breake forth on the superficies of the ground: By the latter it may be lifted high enough, to runne from the side of a higher mountaine, towards the *Sea-shore*. If any man should aske why this *Raresfaction* & swelling of the Water is not so sensible in the open *Ocean*, I answere that the sea is also much rarified & lifted vp by reason of the sunnes heate: which whether it be the cause of ebbing and flowing of the sea, in part we haue before disputed: Secondly that the *sea-water* should not rise so high as other water vnder the ground, these reasons may be giuen; First that the *Ocean* hath a larger channell to runne abroad on either side, and so this swelling must of necessity become more insensible, whereas the Waters in cauerns & concavities of the Earth, being oftentimes straightly bounded on either side, by the narrownesse of the channell, must of necessity take vp the more in hight and eminency: a
the

the *Sunne*, *heavenly bodies* and *subterranean fires* worke more strongly and effectually on the open nakednes of the sea, then on the waters hid vnder the ground, which are more shrowded from such an extreame heat. Whence it comes to passe, that many parts of the *sea*, are dissolued into *vapours*, and to consumed and dispelled by the same; Whereas this heat in the *Subterranean* waters being more moderately impressed; doeth not dissolue into vapours, and consume so great a quantity of water; but being of a middle temper, rather rarifies it to the vse forenamed. This seemes the more probable, because spring water rising commonly in the sides of mountaines, is for the most part thinner then the Sea-water, as experience daily warrants. Thirdly the *subterranean* vapours are; sooner dissolued into dropps of water by reason of the cold they must necessarily meete within their passage, through the *Earth*; whereas the other from the *Sea* meet with no such encounter till they arrive at the *Middle-Region* of the *Aire*, whence they returne againe in showres of Raine.

2. *All riuers and Fountaines were not from the beginning.*

For the confirmation of this assertion, many histories may be produced: It is reported that in *Caria* neere about the city *Eorus*, there arose out of the Earth suddenly a great floud of Water, bringing out with it a great quantity of creatures and fishes, of which being fatted vnder the Earth, whosoeuer chanced to eat, dyed presently. The like is reported, that at the time of the *Mithridaticke* warre, at a certaine city of *Phrygia* named *Apamea*, there sprang vp out of the ground many new *Lakes*, *Fountaines*, *Brookes*; and that one riuer sprang vp very salt, which brought vp with it a great quantity of *Oysters*, and other *Sea-fishes*; although the city *Apamea* bee very farre off from the *Sea*. This is reported by *Nicolaus Damascene*. Also *Cardinall Contarenius* testifies in the second booke of Elements, that in a cleare day being in *Valentia* in *Spaine*, there happened a very great inundation of water breaking out of the Earth, which being carried towards the City, had

had well neere turned it into the Sea, had not the gates bin shut, and dammes well ordered. Why this sudden change should sometimes happen, many reasons may be produced. The first reason may be, because of some sudaine ruine or falling downe of some parts of the Earth, whereby the courses of the riuers being one way stopped, must needs seeke out a passage some other way. This sometimes happens in great *Earth-quakes*, as we may read in *Theophrastus*, that in the mountaine *Coricus*, after an *Earth-quake* many new springs and fountaines discovered themselves. Another reason not much vnlike the former is giuen from the *Hardnes* of the Earth, which oftentimes stopping and hindering the naturall course of the water, enforceth it to seek a new passage. Hence the foresaid *Theophrastus* was induced to believe, that in a City of *Crese* the fountaines were stopped vp because the Inhabitants betoke themselves to another place; so that the soile was not so much shooke and moued as before. A third reason may be the wasting or cutting downe of great woods on the Earth; for it is the nature of the Trees and plants to suck to themselves the Moisture of the ground into one place. But these trees cut downe or remoued, the waters course must needs be altered.

3 Many Riuers are for a great space of land swallowed vp of the Earth: whereof some after a certaine distance rise againe.

This is confirmed by many Historicall instances, as of the riuer *Timanus* in the prouince of *Aquila*, of *Erasmus* in *Argolica*, *Padus* in the *Alpes*, more remarkable is that of the riuer *Guadiana* in *Spain*: which runneth vnder the ground, for the space of 13 leagues: and neere to a towne called *Villa Horra* breakes vp againe: the like is recorded of *Eurotas* in *Arcadia*, which is said to breake forth of the ground in the Prouince of *Lacedamon*. So *Cadmus Asia* is swallowed vp in a hole of the ground, not farre from *Landicea*. So *Piramus* in *Catonis*, *Licus* in *Libanon*, *Orontes* in *Syria*. Other riuers are thought to haue found a secret passage vnder the sea from one Region to

another: As a river having his fountaine in the mountaine *Alpiates*, which being conveyed in a blind Channell vnder the middle of the sea, comes forth againe at the port of *Panormus*: so others report of *Alpheus*, which being drowned vnder ground nere the *Peloponnesian* shore, takes a large iourney vnder the Sea, till it arrive at *Syracuse*, where it ends in *Aretchuse*; which brings forth (they say) such things as are cast into *Alpheus*: which is much like that which is spoken of the Well of *Asculapius* in *Athens*, wherein if any thing were cast, they were rendred againe in *Phalericus*: But this last I rather hold as a poetical fiction, then a true History. Some rivers there are, which are not wholly drowned in the earth; but for some part; as a part of the *Rhaine*, which is hid about foure thousand paces from the city *Caua*, and shewes it selfe again before it come to *Bonna*: in like manner a part of *Danubius* which hides it selfe about *Greina* a Towne of *Pannonia* superior: some rivers there are againe, which are not drunke vp immediately of the earth; but of certaine great Lakes into which they fall as *Jordan* of the Lake *Asphaltiter*: some lakes againe having swallowed vp rivers (as it were) vomit them forth againe, as *Rubrosus* casts out *Arax* in the Prouince of *Narbon*, and so *Lemanus* the river *Rhodanus* in the same Prouince: also in *Italy*, *Lorn* cast out *Abdus*; *Eupilus*, *Lambre*; *Fucinus*, *Marcia*.

4 Rivers for the most part rise out of great Mountaines, and at last by diuerse or one Inlet, are disburthened into the sea.

The first part of this proposition is manifest enough out of diuerse instances of the greatest rivers in the world: for all Geographers will giue you to vnderstand, that the river *Indus* in *India* is deriued from the mountaine *Caucasus*; *Tanaïs* from the *Riphean* mountaines in *Sarmatia*, *Araxis* from *Parades* in *Armenia*, *Po* from the *Vesufian* Hills in *Liguria*, *Danubius* from *Arnobius* in *Germany*, *Exesus* in *Norica* from the mountaines *Elachis* *Isara* from the ridge of the *Alpes* toward *France* and *Durius* toward *Italy* from thence. So from the *Hermian* moun-

mountaines in *Portingall* are deriued three great Riuer: So *Nilus* in *Africk* from the mountaines of the *Moon*: These ri- uers thus rising, are of diuerse kinds; for some haue visible ap- parant *springs* and fountaines: others are deriued from *Lakes*, out of which they runne. As *Alba* in *Prusia*, out of *Elbinga*, *Medoarus* & *Oxus* out of two lakes of the same names, neere the *Alpes*; *Rindacus* from *Arzima* a poole besides *Meliso- polis*. The reason why riuer should be ingendred in moun- taines, and such high places, may be giuen; because they are made (as we shewed before) by the heat of the sunne, starres and subterranean fires, rarifying and attenuating the Waters. And this operation of the sunne in higher places, must needes be more effectuall then in lower. Now for the second part, it is plaine to proue, that all riuer runne into the sea either mak- ing a passage from their fountaines, on the land toward the sea shore, as *Nilus* and *Danubius*, with other riuer, or by dis- burthening themselves into greater riuer, wherein they are conuained into the sea: as the 60 great Navigable riuer, which empty themselves into *Danubius*, or atleast are swallowed vp of the Earth, and so reduced againe to their first mother; which we may imagin of the riuer forespoken of, drunk vp of the Earth: Although all riuer (as we shewed) fall into the sea yet not all in one & the selfesame fashion; if we respect their passage on the lād. For some are caried into the sea by one *offi* or mouth, whereof we haue two notable examples; the first of a great riuer in *Brasill* called *Rio de La Plate*, which is cari- ed into the sea, by a mouth of 40 leagues with such violence, that the Marriners may thence draw fresh water, before they come within sight of land. The other not much unlike, is that which runnes by the kingdome of *Congo* & *Angolo*, which is fix and thirry thousand paces broad, where it enters into the sea, and is caried with such a sforce, that it seuers the waues, & keeps his owne channell, and renders the shipp-men fresh water berwixt the sea waters, for the distance of eight hūdred thousand paces. Other great riuer are disburthened into the sea, by diuers *Offia* or *Inlets*; as *Rhene* into the *Germane Ocea-* an by three; *Danubius* into the *Pantiok* sea, by 6; *Indus* into the

the *Indian* sea by 7; *Nile* into the *Mediterranean* by 7 great and famous passages: *Volga* into the *Caspian* lake by 72 gates. These are the most remarkable: others we shall supply in our *historicall* part.

5 *Diuers*e fountaines are endowed with di-
uerse admirable vertues and operations.

There is nothing wherein *Nature* delighteth more in miraculons variety, then in fountaines and springs of the earth. Of these admirable workes of nature, being infinite in these springs, I will touch some. Which the better to effect, I will reduce all to these heads: 1. Their *qualities* and operations. 2. their motions. For the former we will produce some few instances. It is reported, that neere the *Garamantes* there is a fountain so cold in the dayes that no man can drinke thereof; so hot in the nights, that no man can abide to touch it. There is another in *India* wherein a candle will burne. There is also another called heretofore the well of *Jupiter* *Hammon* which in the morning is luke-warme: at noone cold; in the evening Hot; at midnight boiling hot; From whence againe it begins to assuage till the morning; and so (as it were) by turne it growes hot and cold; a matter of great admiration. Some fountaines in *Liguria* & *Paphlagonia* being drunke will make the head giddy as if he had drunke wine. Another fountain in *Aranea* a part of *Armenia* being drunke, will so affect the fall, that who drinke it shall neuer afterward endure the taste of wine, which was very like the fountain *Clitorius* whereof *Ouid* in his *Metamorphosis* the last booke sings in this manner. *Clitoria quia nunc, sicinde fons laetitiae;* *Vina super gaudet, meris abstemius undis.*

The ancients haue also recorded, that in *Boaria* neere the ri-
uer *Archemaron*, are two fountaines; wherof the one gets
memory, the other causeth oblivion. There is in the *Land* *Cra*
a fountain making the senses dull; another in *Ethiopia*,
whercon the Water drunke will make a man mad. Some
water absolutely kills him, which drinke; as the river *Syr* in
Armenia, being a venomous fretting poison, and therefore
by.

by the poets fained to be one of the riuers in Hell. Diuerso-
ther riuers are profitable to cure diuers diseases of the body,
whereof I need not bring any instances; because such new-
found wells are sometimes discouered amongst vs here at
home. There are 2 riuers in *Boetia* of admirable vertue,
whereof the former, if a sheep drinke of it, he will become
yellow: but if a *sheep* of a dunne or yellow colour drinke of the
other, he will become white. Riuers which make sheep white
coloured besides, are *Neleus* in *Eubœa*, *Aluicmon* in *Macedo-
nia*, *Crathris* in *Thurijs*: so *Cerius* in *Eubœa*, *Aucius* in *Ma-
cedonia*, *Peneus* in *Thessaly*, will make them blacke: *Chymæus*
will cause whitenesse in oxen: So the riuer *Assacus* in *Pontus*
waters the land, whereby *mares* haue their milke blacke. A-
mongst the regions of the *Troglodites*, there is a well which
thrice a day will become sweet and bitter, and againe returne
to his former sweetnesse: and so often againe in the night. This
may suffice to shew the variety of operations in these wells, in
respect of other creatures. No lesse admirable variety is
discouered in observing of their diuers motions. For some ri-
uers overflowe their bankes at some certaine times of the
yeare, as *Nilus* in *Egypt*, *Euphrates* in *Mesopotamia*, *Indus* in
India: some fountaines are carried with such violence, that
they cast vp stones, as *Marsus* in *Phrygia*, and expell any
weight as a certaine one in *Arabia*, whereof the like was re-
corded to be in *Portugall*: some will swallow vp any thing
throwne into them, as one in *Portugall*, if we beleue *Pliny*:
some others although they are cold, will seeth and seeme to
boile as the water on the fire; yet neuer cast out their water
beyond their bankes, but straight way swallow it vp againe,
as *Acidula* in *Albagona*, and another fountaine in *Cappidocia*
named *Tianus*: some there are which sometimes rise and swell,
and other times fall againe of their owne accord, as *Crater* of
Tauris, and a fountaine in *Italy* called *Phisius*: some wells
imitate the ebbing and flowing of the sea in all encreases and di-
minutions, as one in *Cales*, and the other neare *Burdeaux* in
France: some are contrariwise affected to the ebbing & flow-
ing of the sea, flowing when the sea ebbe, and ebbing when the
sea

flowes as certaine *Pits* in *Spaine*: some encrease and diminish without any consent or agreement with the motion of the sea; as a Well in *Tenodus*, an Island neere *Troy*. In *Cantabria* are three fountaines, distant 8 foot the one from the other, and falling into one Channell in a vast river, which euery day are dry twelue times, and sometimes twenty times: others of their own accord purge & cleanse themselves, casting out wood, clay, durt, and other matters wherewith they are defiled, as a Well in the *Chersonesus* of *Rhodes*; These and many more remarkable instances haue our naturall Historians gathered together, whereof though some perhaps may bee thought to be forged of *Poets* for pleasure, or mistaken for want of good discouery and obseruation; yet must wee not wrong *Antiquity* so much as to reiect all, haniing in this subject enough to wonder at in ourowne Country.

6 *Places neare great Riuers and Lakes are most commodious for habitation.*

It hath bin the custome of all times and nations almost in the world, to choose out for a choice place for building of cities, their habitation neere some great *Lake*, *Riuer*, or *Arme* of the Sea; which sprang from the common obseruation of Men, who found such places to be more conuenient. This conueniency is shewed many wayes: first, because by meanes of such water they haue quick passage and trafficke with other Nations, being able with more ease both to receiue, & to send forth wares and merchandize. Whence we see that such cities as are seated vpon the water, are commonly of all other the richest: whereof we may giue an instance almost in euery country, as of *Senill* and *Lisbone* in *Spaine* & *Portugall*: of all the Cities almost of the *Low-countries*; of *Paris* in *France*: whence (no doubt) grew that English Prouerbe; *That the Sea is a good neighbour*; which may aswell be vnderstood of any nauigable *Riuer*. Secondly such a site is most conuenient for the purging away of all filth and excrements, which could not with the like conueniency bee so soone transported by land: whence many men haue laboured to transport riuers far

remote vnto Cities. Thirdly, because such riuers and watry lakes yeeld store of *fish*, whereby the Inhabitants may be nourished, and other creatures the better preserued. Fourthly, no small commodity would accrew to a City by water in eare adioyning. If it should chance (as often it doth) to be set on fire, for hauing water neare it, it may soone be quenched: whereas many little springs cannot afford so much water as would suffice for such a purpose. Lastly, amongst other reasons, wee cannot forget the pleasantnes of faire riuers, which are no small ornaments to a City, and delights to the eye of the Inhabitants.

8 Thus much for riuers: A Lake is a collection of perpetuall waters, nourished with fresh springs, and hauing of it selfe no passage forth.

In this definition of a Lake, wee haue comprized these three things: First that it is a collection of constant and perpetuall waters: Secondly, that it is continually fed & cherished with fresh springs, rising vp from the bottome. Thirdly, that it finds no passage forth into the sea or otherwise. By the two first it is distinguished from a great *Pond* or standing poole, called in Latin *Stagnum*: For as much as a standing poole, being commonly fed with raine water, and hauing no springs from the Earth whereby it may bee long nourished, is often times by the heat of the sunne exhausting it out by vapours, either extraordinarily diminished, or altogether dried vp. Whereas in a Lake by reason of fresh springs, the Water is perpetuall and remaineth sweet and holosome, except by some other accidents, it change it's disposition. For the latter clause that a lake finds no passage forth, it may bee two waies vnderstood: either of a *visible* or apparant passage outwardly through the superficies of the Earth to the sea, or of a *secret* and subterranean passage vnder ground: The former may againe be vnderstood of a passage forth immediatly by it selfe, or immediatly by some riuer: whereas wee haue said that it finds

finds no entrance into the sea, we ought to vnderstand it, that immediately it is not to be accompted a continuare part conioyned with the sea: neuertheless it may be disburthened into the sea by some riuers running out of it, as some would haue the great riuier *Tanaïs* not to haue his head or fountaine in the *Riphean* mountains, as the ancients haue taught; but in a certaine Lake not farre from the city *Tulla* to *Volga* & *Edill* draw their originall from a lake not farre from *Moscow*: with many others of like nature. What to thinke of the *subterranean* intercourse betwixt *Lakes* and the sea, wee will shew in this Theoreme.

It is probable, that most *Lakes* haue some secret intercourse with the sea vnder ground.

For the confirmation of this point, there want not reasons: The first reason may be drawne from the quantity of Water in most *Lakes*, which is found without any great sensible difference to remaine the same, without any diminution or encrease; whereas if the water bound in with these limits, should haue no passage out any way, it should encrease to such greatnes, that it would easily ouerwhelme the bankes To giue a few instances, we find that diuerse very vast riuers exhaust themselves into the *Caspian Lake* as *Volga* and *Edill*, which receiuing into them many notable riuers, are at last themselves swallowed vp in the said lake: In like manner the Lake of *Palestine* called the dead sea, is known to receiue into it besides diuerse lesser riuers, the great and famous riuier *Jordan*. Heere would I demanda, whether these great riuers perpetually casting themselves into a Lake, giue an encrease to the former quantity or not: if they should augment the water, they would by consequence alter the bounds: But this is contradicted by experience. If the quantity of the water suffers no encrease, it must needs follow then, that the water should some other way be diminished, as it is heere encreased. This must either be by the sunne drawing vp some parts of it by vapours, or by some cauerns of the Earth, drinking vp some parts of it: Or lastly by a subterranean passage into the

the sea: Concerning the former it cannot bee denied, but much Water is drawne vp into *vapours* by the heat of the *sun* yet that these vapours countenaile the water perpetually brought in, is in my conceit very improbable: for against this quantity of water extracted out this way of *evaporation*, I will oppose these three things which shal perswade a reasonable man, that the water received in, shall farre surpass the vapours exhaled from it. First that the vapours are stirred vp in the day time, when the sunne is lifted above the *Horizon*, at such a height that his heat is somewhat strengthened, whereas all these watry currents neuer intermitting their usuall course, neuer cease to runne by *day* or *night*: wherein is seen a double advantage of the riuers, in respect of the watry exhalation: Secondly of these watry vapours, so drawne out, a great part must at diuerse times returne back, or at least so much otherwise by *rainy* showres, dropped downe into this *Lake*. Thirdly, these watry parts thus rarified and attenuated in vapour should (putting this supposition) in equality, diffuse themselves abroad in such extraordinary manner, that all the Regions round about should in all likely-hood suffer a great inconueniency of foggy exhalations. On the other side it is very vnlikely, that it should bee receined into empty caverns of the Earth, without passage into the sea, or some great riuer, disburthening it selfe thereunto. For I would demand whether these cauerns were euer filled with water or not? if they haue been filled, how could they receiue more water, sith the filling of any place supposeth it to be first empty. That they were neuer yet filled with Water, is farre more vnreasonable: that any man should imagine, any cauerne of the Earth to bee so vast, with so great currents of Water perpetually running in almost six thousand yeares, should not replenish: especially considering the bowells of the Earth, not farre from the vpper face, to be every where spread with Water round, which might also holpe to this purpose: Wherefore it cannot well bee imagined but that euery such great lake, hath some vent or passage vnto the sea, either by some *secret* & subterranean channell, or

at least by some great *river* issuing out of it, and so running into the Ocean. Another reason may be taken from the currents of some seas, which are by good reason ascribed to this cause: For it is obserued by skilfull Nauiगतours, that the Water is carried by a very stiffe course from *Propontis* and the *black sea* into the *Egean*, and from thence into the *Mediterranean*: The originall of which current may with good coniecture be found out in the *Caspian*, which by some secret passage vnder ground, disburthening it selfe into the *black sea*, causeth it to enforce his owne waters farther off, for the receipt of the other. Thirdly that these subterranean passages are not vnlikely, may be confirmed by many *riners* which are swallowed vp, some wholly, some for some place only of the Earth, whercof we haue spoken before. Also it may seeme likely by the Water, spread round about the Earth, which through the bowells of it find a passage from the sea, bearing as it seemes the same leuell. This may (for ought wee know) be the originall of all *Lakes*, and this also may bee a way or meanes, whereby they empty and disburthen themselves being ouercharged with too much Water.

CHAP. X.

*Of Mountaines, Valleys, Plaine Regions,
Woods, and Champian Countreys.*

THe second variation in the figure of the Earth is expressed in *Mountaines, Valleys, and Plaine Countreys*. A Mountain is a quantity of Earth heaped aboue the ordinary height
 Ll 3 of

of the land. A Valley is the depth of the Earth between two Mountaines. A plain is a space of Earth where there is found no notable rising or falling of the ground.

The distinction of the Earth according to it's externall figurature into *Mountaines*, *Valleyes*, and *Plaines* is very naturall; because euery space or parcell of land in respect of the places neere or about it, must either rise higher, or fall lower, or at least must beare an equality; where the former is admitted, there must needs be *Mountaines* swelling higher then the ordinary leuell of the Earth; where the second is found, the ground is indented with *Valleyes* and *concauities*: where the third is to be scene, there must be *Plaines*. Here is to be noted that howloeuver *Plaines* absolutely considered, haue a sphericall surface for the most part, especially, if the *Plaines* be large, because they concurre as circular segments to make vp the *Sphere* of the Earth; yet they may be called *Plaines*, because they so appeare to our sense, which in so short a distance, cannot perceiue the *Sphericall* figurature of the Earth; Some *Gramarians* here curiously distinguish betweene *mons* or a *Mountaine*, and *Collis* or a *Hillock*, which is a little hill: & also betwixt *Vallis*, which they would haue to be a low parcell of ground betwixt two mountaines, and *Conuallis* which is a lower space, only bounded on one part by a *mountaine*, which *Varro* would haue to bee deriued from *Cauata vallis*; but these *Grammatical* scruples are of small vse to such as spend themselves on greater matters: because the ordinary & visual manner of speech (euen amongst the vulgar) will shut out all mistakes in this kind; what deserves the study of *Topographers* concerning this, shall be expressed in these *Theoremes*.

I Mountaines, Valleyes, and Plainses were created in the Earth from the beginning, and few made by the violence of the Deluge.

It hath bin the opinion of some, aswell *Divines* as *Philosophers*, that the violence of the *Deluge* hath extraordinarily altered & defaced the Earth, being the chiefe cause of *Mountaines & Valleys* therein: but this opinion is contradicted by many reasons; first out of the Text it selfe of *Genesis*, where it is said, that the water of the flood over-flowed by 15 Cubits the highest Mountaines: to which may be added the Testimony of *Damasceus*, who reports, that in the time of the *Deluge*, many resorted to a high mountaine of *Armenia*, called *Baris*, where they saved themselves which last clause although it expressely contradicts the holy *Scriptures*, which speake but of Eight Persons that were saved: yet it is a sufficient testimony to prove that such Mountaines were before the Flood, and therefore not made by it: Secondly had there followed to great an alteration of the Earth, to cause *mountaines* as some imagine, then should not the same places after the flood retain their names, bounds, and descriptions, which they did before the flood; the contrary whereof we find, in that *Moses* writing of *Paradise*, & other places, about 850 years after the flood, was most exact in setting down the *Names, Limits*, and whole description of them, as though they had remained to be seene in his dayes. Thirdly, had the violence of the waters beene so great as to raise vp mountaines in the Earth, it would without doubt haue bin forceable enough to haue turned *Riuers*, and haue changed them from one place to another, cast downe and demolished the greatest *Cities* and buildings, throwne downe and over-whelmed all plants and vegetalls on the Earth, and (as it were) haue buried from all succeeding time, the memories of the former ages, so that little or nothing should appeare: but this may bee proued otherwise by sundry Instances: First that the *Riuers* haue still remained the same, may appeare out of the place alleaged of *Genesis*, where *Moses* speaking of the site of *Paradise*, sets downe all the riuers of it exactly, especially *Tigris & Euphrates*: out of the which we may easily gather in what *longitude* and *latitude* it stood: had any thing bin altered in the course of the riuers, it is likely *Moses* would haue speci-

fied it in this *Hiftorie*, that after ages looking for these places, might not mistake or suspect the truth of his Relations: Secondly, that it hath not extinguished all *Buildings*, and ancient monuments of the fathers before the flood, may probably be coniectured by the testimony of *Iosephus* a writer of good credit, who affirmeth that he saw one of the pillars, erected by *Seth*, the second from *Adam*; which pillars were set vp above 1426 years before the flood, accompting *Seth* to bee a hundred yeares old at the erection of them, and *Iosephus* himselfe to haue liued some 40 or 50 yeares after *Christ*; Now although we are not bound to credit all that he relates; yet may we trust him concerning such matters as happened in his time; and that this pillar was set vp by *Seth* was neuer yet called in question, but warranted by antiquity: the like is recorded by *Berosus* of the City of *Enoch*, that it was not demolished by the flood, but remained many yeares after, the ruines whereof as *Annius* in his commentary reports, were to be seene in his time, who liued in the time of *Ferdinand* and *Isabella* of *Castile*. It is also reported by *Pomponius Mela*, that the City of *Ioppe*, was built before the flood, of which *Cepha* was King, whose name with his brother *Phineus* together with the grounds and principles of their religion, were found grauen vpon Altars of stone: All which are sufficient to proue the violence of the Waters, not to haue bin so great to demolish all *mountaines* and *monuments*: Moreouer it may be plainly proued out of the text, that the Waters suffered the plants and trees of the Earth to grow, and remaine as they did before; because it is said, that when *Noah* the second time sent out the *Dove*, she returned with an *olive* branch in her mouth, which no doubt she had plucked from the trees, after the trees were vncovered; for otherwise she might the first time haue found it floating on the Waters: a manifest proof that the trees were not torne vp by the roots, or turned topsy turvy, but remained fixed in the Earth as they did before. Fourthly, had the water suffered this extreame violent motion, as whereby it might make many *mountaines*, I aske, whence this motion should come? It could not bee from the naturall

naturall motion of the water, which is to moue downward: for what descent of waters can bee in a *Spherical* round body, where no part is higher, or lower? That there was any wind to driue and enrage the Waters, is very vnlkely; because it is said, that God caused a wind to passe vpon the Earth, and the Waters ceased: so that there was no wind till the Waters sanke: Lastly, wee may argue from a *small cause*, that this inequality in the superficies of the Earth was before the flood; because it is certaine that all things were in as good or better estate, then now with vs, and that the Earth was adorned with all varieties of creatures as well for profit, as *delectation*. Now it is found by experience, that all commodities agree not to all places, but some are found in the mountaines, at all sorts of *mettalls & mineralls*, *Plants*, & *Vegetalls* for the most part prosper best in the *vallies* and *plaines*: Also that the mountaines serue for a shelter to guard the vallies from the rigor of *cold* and *wind*, both for the better conuenience of mans life, and encrease of fruits for the vse of man: Whence we may conclude, that it is farre more probable, that the great *Mountaines* were so created in the beginning, and not made by the flood; yet can wee not deny, but that some *small Hillocks* might be made by the flood, and afterward by the industrie of man, which haue raised great *fortresses*, and bulworks, which afterward decaied, were made great heaps of Earth (as we see many in this land) but this is of small note & not worthy consideration, in comparison of the great mountaines of the Earth whereof we especially treat.

2 *The perpendicular height of the highest mountaines seldome exceeds 10 furlong.*

This proposition depends on the authority of *Eratosthenes* a famous *Mathematician*, who being employed by his King, found out by *Dioptrick* Instruments the height of the highest mountaines, not to exceed the quantity aboue specified, *Cleomedes* extends this a little farther, and would haue some mountaines to attaine the height of 15 furlongs, of which height he would haue an high rock in *Bactriana* called by

Strabo.

Strabo 11 libro *Sisimithra Petra*; But yet if we credit *Pliny* on *Dicaearchus* who measured the Mountain *Pelion* accepted the highest, he found it not to exceed 1250 paces which make 10 furlongs: and *Solinus* relates the mountaines of *Theffaly* to be higher then else-where are to bee found. But this opinion howsoever supported by the authority of the ancient and famous *Mathematicians*, hath been called in question as well by moderne, as ancient writers. Many matters are miraculously, or rather fabulously spoken of the Mountaine *Athos* in *Macedonia*, of *Cassius* in *Syria*, and another of the same name in *Arabia*, of the mountaine *Caucasus*, and others: which Histories notwithstanding are related by no meaner Authors then *Aristotle*, *Metel*, *Pliny*, and *Solinus*, yet it is not hard to imagine, that these Authors might bee deceiued in those times, either trusting to other mens relations, or wanting *Mathematicall* instruments, to search these matters: Of the Mountaine *Athos* it is much wondred at, that it should cast a shadow from *Macedonia* into the market-place of *Mynhina* a towne of the Iland *Lemnos*, distant from *Athos* 86 miles: But this as our learned Countreman *Mr Hues* well obserues, can bee no great argument of such a miraculous height; because the mountaine *Athos* situate East from *Lemnos* (as may be gathered from *Ptolomies* Table) may without any great wonder cast a very long shadow, the Sunne either rising, or setting. Other matters are related of this mountaine *Athos* more strange then the former, to wit, that it should in hight transcend the Region of the raine, and wind, which they would strue to confirme out of an old tradition; that the *albes* heaped together on certaine Altars built on the top thereof were neuer blowne away, but remained in the same manner as they were left: to which may be added out of *Strabo*, that they who inhabit the top of this mountaine, can see the Sunne 3 houres before those who inhabit neere the sea: The like is reported by *Aristotle* of the Mountaine *Caucasus*, that for the extreame height, the top of it enioyes the Sun-beames a third part of the night; Little lesse is spoken by *Pliny* and *Solinus* of the mountaine *Cassius* in *Sy-*

ria and by *Pomponius Mela* of the mountaine *Cassiu* in *Arabia*; But how fabulous and incredulous these things are, *Petrus Nonius* and other *Mathematicians* have sufficiently demonstrated out of the grounds of *Geometry*; more absurd by farre seems that, which *Eustathius* reports of *Hercules pillars* celebrated by *Dionysius Perieges*, for their admirable height; whereas they are found not to exceed 100 *ells* making one furlong; a height according to *Strabo* not exceeding the *Egyptian Pyramides*, and coming short of certaine *Indian trees* neare the River *Hyarotes*, whose *Meridian* shadowes reach 3 furlongs; These errors in the ancient might seeme veniall, had they not bin seconded by latter writers; Of the Mountaine *Tenariffe* in the *Canaries*, *Soaliger* is bold to report out of other mens relations, that it riseth in height about 13 leagues, which make 60 miles; but *Petrivius* more bold then he, would have it 70 miles; Little lesse is spoken of *Pico* amongst the *Azoris Insula*, and the Mountaine *Andi* in *Peru*; But to confute these relations we will vse this argument; It is reported by the *Spanish* writers which have spoken of this place, that the topps of these Mountaines scarce any one or two moneths in the yeare are free from snow: Now that snow should bee ingendred about 60 or 70 miles about the ordinary plaine of the *Winter* or *Earth*, is against the indgmet of our best *Astronomers*; becaute, as they have observed out of *Pythagoras* measure, the highest vapors seldome reach so farre, as 48 miles in height every way from the *Earth*. This argument may as well serve to confute these ancient opinions before mentioned, had they not been so fabulous, as scarce to deserve any solide confutation.

3. The ordinary height of the Land above the Sea in diverse places is more, then the height of the highest Mountaines above the ordinary face of the Earth.

We have probably shewed out of former grounds, that the ordinary height of the Earth is answerable to the ordinary

nary depth of the Sea, so the *hilles* and *mountaines* in proportion anſwere to the *whirle-poolles* and *extraordinary Gulphes* of the Sea: but it is to be imagined that the depth of the Sea in the maine Ocean, is farre more below the ſuperficiēs of the Earth then thoſe other *whirle-poolles* and *Holes* extend themſelves below that depth. But to proue this by a more ſenſible argument we will compare the one with the other, ſo farre forth as *Mathematicians* by experience haue gueſſed; for it is found by *Mathematick Inſtruments* (as wee haue proued in the precedent Theoreme) that the higheſt *Mountaines* ſeldome or neuer mount vpward aboue ten furlongs, which is an *English mile*, and a quarter: but the hight of the Land in ſome places where appeare no ſuch hills, is obſerued to be much more: to proue which aſſertion, we can haue no fitter argument then the freſh *Springs* of *Riuers*; for it is manifeſt that all *Riuers* are higher at the *Spring* or fountain, then at the place where they diſburthe themſelves into the ſea. Now although *water* is apt to ſlide away at any Inequality; yet it is moſt probable that in greater riuers, eſpecially where the waters fall oftentimes with violence (as at the *Cataracts* of *Nile*) much inequality muſt bee granted in the Declivity of the ground: ſuppoſing yet the water for euery mile to gaine two foot in the Declivity of the ground, we ſhall find the hight very neere to equalize the hight of the higheſt *mountaines*; although 2 foot in a mile is farre leſſe then can be imagined in ſo great a *Riuer*. The *Riuer* which I take for an example ſhall be *Nilus*, which we ſhall obſerue to runne about 50 Degrees from *South* to *North*, which reſolued into *miles* will make 3000: accompting for euery mile 2 foot, we ſhall haue 6000 foot, which will be neere theſe 10 furlongs, being a mile and 5 parts; then allowing for theſe mighty *Cataracts* where the water falls with ſo great a violence, we muſt reckon a number of feet far greater then this meaſure; for euery mile muſt the hight of land aboue the ſea be much more then of the *mountaines*.

4. *Mountainous Regions are commonly colder then*

then other *plaine* countries.

This proposition is not absolutely to bee vnderstood without a limitation: for some *plaine* Countries neere the *Arcticke* Pole, may be colder then some *hilly* Regions neere the *Aequatour*, in regard of other concurrent causes: but here we speake (as the *Logicians* vse) *ceteris paribus*; comparing two places either together like, or not much different, or at least in our vnderstanding abstracting them from the mixture of all other considerations: that this Theoreme is worthy credite, diuerse reasons stand in readines to iustifie: the first may bee drawne from the cause of *heat* in Inferiour Bodies, which is the reflexion of the *Sunne-beames*. Now that this reflexion is of more strength and validity in *plaine* then in *hilly* and *mountainous* Countries, is euident: first, because (as the *Optickes* teach) the *rayes* are more ioyned and combined in a *plaine*, then in a *convex* superficies; for howsoeuer the whole Earth be of it selfe *Spherical*, yet the *connexity* being not sensible, by reason of the smallnes of the Circle, whereby the *connexity* is made lesse, it may *optically* be called a *plaine* superficies: Secondly, it is taught in the *Optickes*, that a reflexion is of more validity in an *equal*, then in an vneuen and ragged superficies, such as is found in *Mountaines* and *vneuen* places. A second reason why *mountainous* Regions should exceed others in cold, may be the vicinity of them to the middle Region of the *Aire*; for of all the Regions (if we beleive *Aristotle*) the middle is the coldest, as being more seperate from the *Sunne* the fountaine of *heat*, and the higher Region; farther off from the reflexion of the *Sunne-beames*, then the lower: Now sith the parts of the Earth are affected with the quality of the *Aire*, it must needs stand with reason, that the more it shall approach to the middle Region, the more it must partake of its quality. Thirdly, that this is consonant to obseruation, reasons are vrged by experience of all *Trauellers*; who report the toppes of *Mountaine* neuer in the midst of Summer to be couered ouer with snow, although situate vnder or neare the *Aequinoctiall* Circle: Of this nature are the *Alpes* in *Italy*, the *Mountaines*

of

of the *Moone* in *Afrieke*, *Andj* in *Pern*, and *Tenriffe* in the *Canaries*. That *snow* should be an effect of *cold*, I need not labour to confirme. A fourth reason may bee drawne from other effects of *cold* or *heat*; for it is daily proued by experience, that such diseases as chiefly follow *heat*, especially the *Pestilence* in *Egypt*, and such *plaine Countries*, are wonderfull prevalent, whereas *hilly* and *rockie Countries* by the benefit of Nature stand in little feare of such inconveniences. Last, *no* greater argument can be drawne, then from the disposition of such men as inhabite such *hilly Regions*, who haue all the Symptomes of *externall cold*, and *internall heat*; in so much as *Bodin* seemes to make a *Harmony* and Concord betwixt the *Northerne* man and the *Mountain*, as the *Southerne* man & such as inhabite *plaine countries*, ascribing to the former *externall cold* and *internall heat*; to the latter *externall heat*, and *internall cold*. How farre this comparison will hold, we shall haue more occasion to discuss hereafter, when we come to the consideration of the Inhabitants.

3. *Mountaines* since the beginning of the world haue still decreased in their quantity, and so will continually decrease until the end.

This obseruation *Blancanus*, I know not how truly ascribes to his owne Inuention: but to what Author soeuer we owe it, we must needs acknowledge a pleasant speculation, grounded on good reason. This Theoreme to demonstrate the better, we will first lay these grounds oftentimes before mentioned. First (as appears by testimony of holy Scripture) the figure of the Earth was in the beginning more perfectly *Sphericall*, over-whelmed euery where with Waters. 2. That a seperation was made by translocation of the parts of the Earth, in such manner as some places admitting of concuities, became the receptacle of the waters, other places whereon these parts of the Earth were heaped together, were made mountainous. 3. Hence will follow, that the Earth thus swelling vp in high mountaines, is out of his naturall site and position.

tion: & therefore according to the law of nature, will endeavour by litle and litle to returne to her former state and condition. Now that the Earth hath sensibly suffered such a change since the beginning, it is easie to shew out of experiments: the causes we shall find to be the *water*, as well of the Ruine as *Rivers*, which we shall demonstrate by these Reasons: 1 We see *Rivers* by litle and litle continually to fret and eat out the feet of *mountaines*, whence the parts thus fretted through, by continuall falling downe weare out the mountaines, and fill yp the lower places in the valleyes, making the one to encrease, as the other to decrease, & the whole Earth to approach nearer to a *Spherical* figure then before; which seemes to be warranted by a place in *Iob* 14, where he saith to God; *The mountaine falling, commeth to nought, & the rocke is removed out of his place. The waters weare the stones, thou wastest away the things which grow out of the dust of the earth.* From these Rivers in the valleyes continually eating through the parts of the Earth, as the feete of mountaines are caused those slow but great Ruines called *Labine*, a *lambente*, by which sometimes whole Townes and Villages have bin cast into the next great River. 2 To proue that Raine water challengeth a part in this diminution of mountains, we may shew by the like experience: we see plainly that Raine-water daily washes downe from the Toppes of mountaines some parts of the Earth, whence it comes to passe that the highest mountaines are harder and more rocky then others, as being more able to resist this violence of the water. Hence also it happens that old buildings being erected in the sides of mountaines, have their foundations after a time vncouered, and are much subject to Ruines: an instance whereof may be given out of the *Romane Capitoll*, whose foundation (according to the relation of *George Agricola*) appeares now plainly above the ground, which without question was heretofore deepe rooted in the Earth. In Plaines and valleyes we find all things to happen contrary wise, to wit, that all places in regard of their superficies are raised much higher then they were in times past, The reason whereof may easly be giuen out of the great quantity of the Earth, carried by the washing

of the Raine from the Topps of mountaines into the valleyes: whence we may perceiue old houses, heretofore fairely built, to be now almost buried vnder ground, and their windowes heretofore set at a reasonable height, now growne even with the pauement: so some write of the Triamphall Arch of *Sep-timius* at the foot of the Capitoll Mountain in *Rome*, now almost couered with Earth, insomuch as they are enforced to descend down into it by as many staires as formerly they were ysed to asced. In like sort we see in old Monasteries & Religious houses, their lower roomes, windowes, & doores, very far couched vnder ground, of which great inconuenience we cannot suspect the Architects iudgment, but rather our fore-mentioned cause: from this burying of parts of some houses vnder ground, it may be gathered, that the farther they are vnder ground, so much ancienter they are: as we may obserue heere with vs in *Oxford*, that our most ancient Colledges haue the windowes of their lower roomes, some-where altogether choaked vp with Earth without, or at least halfe way, in so much as the flore within, is found to bee farre interior in height to the street without: This is also confirmed by Architects, who in digging vp old foundations, before they came to firme ground whereon to erect a building, are enforced first to remoue away the *Rubbish* or (as they terme it) the *Made-ground*, wherein oftentimes they find *Wood*, *Iron-Instruments*, *old coine*, with diuers other Trash of this Nature. An instance we haue in some of the lower places in *Somersetshire*, where some vpon occasion digging the Earth somewhat deep, haue found great *Okes* turned topsy turvy with their Roots vpwards. To coniecture with some, that this was caused by *Noah's Flood*, seemes to be very improbable: 1 because as we haue formerly shewed in this Chapter, the Water in the *Deluge* could not haue so violent a motion to procure such an alteration in the parts of the Earth. 2 It cannot so well be imagined how such Trees should remaine so long a time without putrefaction: wherefore we cannot well cast it on any other cause, then the addition of the earthly parts, brought by raine from the mountaines into the valleyes: and

so by some Land-flood which partakes much of slimy and earthly matter dispersed abroad vpon the land about. Now on the contrary part wee find in few places of mountaines such *made-ground* which hath before beene moued. This will also appeare out of the industry of our *Low-countrayman*, who by baying vp the Riuers into certaine Artificiall Channels, the ground about hath been much raised: where on the contrary side the forcing of the water into higher places, oftentimes is found to fret through the Earth, and make it lower. What we haue spoken of the effects of Riuers and Raine in diminishing the greatnes of the mountaines and exalting of the vallies, we may in some sort find in the sea. For the bottome of the Sea being lower then the Earth, and many great Riuers continually running from the Earth into it; it is manifest that there is carried in their current a great quantity of earth, in so much as by the heaping of sand and earthly rubbish, the mouthes of great Riuers are in time choaked vp, and commodious hauens spoyled and removed farther into the land: of which alternall transmutation of the Sea and Land we shall speake hereafter: & for present instance need to goe no farther then diuerse Townes in *Denon*, which (according to the Relation of ancient men) haue heretofore been faire hauens, able to receiue great ships, to which notwithstanding at this time a small boat cannot arriue except in a full Tide. The like whereof is reported by *Aristotle*, 1. of a place in *Egypt* called *Delta*, made by the heaping vp of sand and slime, brought by *Nilus* from the *Ethiopian* mountaine. 2. of *Armania Regio*, which in times past being Sea, through the slime conuayed in the Riuers, became afterwards as a standing poole, which in proceesse of time waxed dry, and ioyned it selfe to the Continent. 3. Of *Maotis Palus*, that the dry land enuironing it round, is so much encreased, that ships of that burthen cannot arriue, which could in times past within 60 yeeres before; which is also in some sort testified by *Polybius*. 4. The like is related of *Bosphorus Thracius*, and many other places recorded by *Pliny*, of which we shall speake hereafter. From these obseruations *Blancanus* would inferre these coniectaries: 1. That the Earth was not from the

1 Meteor.

Lib. 4.

beginning endowed with mountaines : 2 That it should not so continue vntill the end of the world ; and vnlesse the Fire (whereof the Scripture speakes) should preuent it, the whole Earth should in the end be ouerwhelmed with waters , as in the beginning, and so be made void of habitation : but on such coniectures I dare not too boldly venture , being speculations built on no sufficient grounds . All which can hence warrantably be collected is expressed in our former Theoreme.

2 Of the *Figurature* of Countreyes in *Mountaines, Valleys, and Plaines*, we haue spoken : It is requisite here wee speake somewhat of *Woods* and *Champion Countreyes*.

3 A *Wood* is a Region or space of Land beset with trees. A *Champion Region* is a space of Land either altogether void, or scarce furnished with trees.

Some Criticks here curiously distinguish in Latine, betwixt *Sylua*, *Lucus*, and *Nemus* : by *Sylua* vnderstanding a space beset with trees , ordained to bee cut downe ; but *Lucus* was a place where trees were, not ordained to bee cut downe , but reserved sacred : For in such groues they did anciently vse to offer sacrifice, as may appeare by diuerse places out of the Old Testament , where the Heathenish manner of worshipping was forbidden, and sometimes reprobred in the Kings of *Iuda* and *Israel* : That which the Latines call *Nemus* , is a Groue or Wood ordained onely for pleasure and recreation : but the discussing of these businesses rather belong to a *Grammarians* then a *Geographer* ; who takes little notice but of those matters which most principally and remarkably belong to any Region ; wherefore omitting other curiosities , wee haue distinguished onely betweene a *Woody* and a *Champion Countrey* ; whereof (as wee haue defined) one is beset with a multitude of trees ; the other with few or none. What concernes a *Geographer*

grapher to observe in those matters, shall generally be comprised in this Theoreme.

Woods in these dayes are not so frequent, nor so great as in ancient times.

We cannot imagine otherwise then that the Earth soone vpon the flood, bearing in her wombe the seeds of all vegetals, being inwardly moistned, and outwardly comforted with Heat, should presently abound with plants of all sorts; in so much as in a short time each thing propagating it selfe by communication of his own seeds, the whole Earth was ouergrown as one Forrest: but afterwards as man began to spread and multiply on the face of the Earth, these Woods and Thickets began to suffer chastisement vnder the hand of laborious husbandry. For first to open a passage from one place vnto another, and that some parcels of ground should as pastures bee divided from Woody acres, it was necessary that this great plenty of trees should suffer a decrease: yet little had this beene noted in so vast a store, had not the inuention of building of houses by little and little turned great Forrests into Cities; which for the most part owed not only their first originall, but also their daily reparation to Trees and Timber: but aboue all the greatest deuourer of Woods and Forrests is Fire, an element fed and nourished almost of no other matter. For to let passe the ordinary vse of fire in euery house and family, which in so infinite a multitude of people, in so many yeeres since the Flood, must require an extraordinary proportion of wood and fuell, how many Arts haue beene since inuented, depending onely vpon this Element? we will goe no farther then the Art of *Liquefaction*, fining of gold and other mettals, found out in the bowels of the Earth, wherein the couetousnesse of men hath beene as vnfatiable as the fire. To this which wee haue said, may probably be opposed two things: first, the power and inclination of euery Creature to multiply and propagate it selfe. Secondly, the industry of mankind in seconding that inclination: Whence it may bee coniectured that great woods should by durance increase to a greater quantity: for the former, no man

will deny, but that plants and trees left to themselves, will commonly propagate their kind: neuerthelesse it cannot preuaile so much as the other, which procure the decrease: first because the Earth being dryer now, then soone vpon the Flood, cannot so much further the growth of vegetals as then it did: Secondly, because (as wee haue said) this growth in a populous Countrey, cannot bee so great as the diminution, since few or no houses can want so necessary an Element as fire. To the second wee answer that mans industry hath done somewhat in plantation of groues, and such like: but how little is this in comparision of the huge and vast Forrests in time by man waited and consumed. We shall read of *Germany*, that in the time of *Cesar* it seemed a wilde Countrey, hauing many great woods and Forrests, but few Cities: but now the case being altered, we shall find the Cities both in number and greatness increased, and the Woods diminished. Two instances may suffice, the one of the Forrest of *Ardenna* in *Lutsemburg*, accounted in *Cesar's* time 500 miles ouer, now scarce 50. The other of *Sylua Hyrcinia*, which heretofore (if we beleue *Histories*) reached so far as a man could trauaile in 60 dayes, but now is made the ouely limit or bound diuiding *Bohemia* from the rest of *Germany*. The like may bee obserued almost of euery other Countrey reduced to ciuility.


2 *Places moderately situated towards the North or South Pole abound more in Woods then neere the Equatour.*

This situation wee vnderstand to comprehend almost all the temperat Zone, reaching either way so farre as 60 degrees or there about. The demonstration of this Theoreme depends of these two fomentes of all plants, Heat and Moisture; both which concurre, not only to the abundance and fertility, but also to the greatnesse of all plants; for it is most certaine, that wherefoeuer these two vitall succours are wanting, or deficient, there must be a great scarcity of trees, fruits, herbage, and such like: This is the cause why the Regions far North neere
about

about the Pole, beyond 60 degrees, haue not onely scarcity of trees, but haue them such as are, of a farre smaller quantity then other Regions, lying more temperate: For the internall and naturall heat is almost extinguished, with the extremity of cold, and the moisture (as it were) dried vp by the frosty disposition of the Region. To this cause may wee ascribe, that which Geographers haue deliuered concerning Island, that for want of Timber they couer their houses with fish-bones, digging out houses in the sides of Rockes and mountaines. Morcouer that the meere defect of moisture may cause a scarcity of growth, may bee proued by many places: 1 because temperate Regions, which are Mountainous and lying higher, produce trees of small length; *Bodin* testifies as a thing very remarkeable, that hee hath obserued oakes in *France* not exceeding 3 or 4 feet. But this is no great wonder with vs in *England*: sith in the dry and barren plaines about *Salisbury* there are many examples not much different: All which, we can ascribe to no other cause then the want of moisture. On the other side as great or greater a defect of heat & moisture, is found neere the *Equatour*, by reason of the externall heat of the Sunne; which in all plants and vegetalls, not onely euaporates the moisture, and by consequence causeth drowth; but by the extraction of Internall heat, leaueeth a greater cold behind, correspondent to that humour in a man, which we call *Melancholy* and *choler-adust*: But this extremity of heat causing this defect of internall heat & moisture, wee place not directly vnder the Equinoctiall; because we haue shewed it to be more temperate: but rather vnder the *Tropicks*, which by experience are found scorched with great heat. How subiect these places vnder the *Tropicks* are to this sterility, we need goe no farther then *Libia* and *Numidia* to confirme; Places by the report of traauilers, indigent not onely of Woods and Trees, but almost of all vitall succours. Whereas the Woods & Forrests dispersed almost in euery region of *Europe*, and the more temperate parts of *Asia*, are celebrated of all writers. Yet whereas wee haue defined the chiefe places for the growth of Woods to be towards the North, so farre as 60 de-

grees or thereabouts; wee cannot warrant this as an absolute generall obseruation; because some places lying very low, and subiect to much moisture, though situate more Southerly, may enjoy this proportion, as we haue formerly shewed of trees neere the Riuer *Hiarotis* recorded by *Strabo*, to haue their noone shadowes of 5 furlongs, as also of certaine trees in *America* neere *Rio Negro*, wherein (as *Peter Marty* writes) a King dwelt with all his family. But these places howsoever situate towards the South are (as *Geographers* deliuer vnto vs) most times of the yeere ouerwhelmed with Water, consisting all of marish grounds: yet these few instances drawne from the particular disposition of the Earth it selfe, cannot much impeach our proposition, which takes notice only of the situation of the Earth, in respect of the cardinall points of North and South, compared with the Heauens.

CHAP. XL.

1.  Itherto haue we treated of the Absolute adiuncts of the land; we are now to speak of the Relatiue, which imply a respect of the Land to the Sea.
2. From this Termination of the land with the sea, there ariseth a twofold distinction; The first is of the land into *Continent* and *Ilands*.
3. A *Continent* is a great quantity of land consisting of many Kingdomes and Regions, not diuided by Water, the one from the other:

An

An *Iland* is a parcell of land compassed round with the sea.

An *Iland* is called in Latin *Insula*, *quasi in salo*; because it stands in the Sea; some would haue it in *English* termed an *Iland*, as it were, *Eye of the land*: But this deriuation seemes affected and not naturall: it might seeme more naturally to be deriued from the *French* *L'Isle*. But wee will not dispute of the name: It is enough to vnderstand, that an *Iland* is a portion of the habitable Earth, euery where enuironed with the sea, or at least with some great Riuer: but this last sense seemes more improper then the other; yet oftentimes vsed, as *Meroe* in *Africa* an *Iland* of *Nilus*, and the *Iland* of *Eely* in *England*. To this is opposed the *Continent*, as that land, which being not diuided and separated by the sea, contains in it many Empires and Kingdomes, as *Europe*, *Asia*, *Africke*, *America*; all which, as farre as wee can yet gather, are vnited and ioyned together, in one continue land; *Strabo* affirms our of this in his 1 Boooke and first Chapter of *Geographie*, that the whole Earth is one *Iland*; sith all these knowne parts of the Earth, are compassed about with the sea on euery side: But this opinion cannot stand with reason, or moderne obseruation: First, because this acception is too large; for as much as an *Iland* is properly taken for a smaller part, diuided from the rest of the land, and opposed to the *Continent*; whereas if this sense were admitted, the distinction of land into *Continent* and *Iland* would haue no place; or at least the same in a diuerse respect, might bee called a *Continent* and an *Iland*. But it is plaine that *Ilands* were alwayes opposed to the continent, to which, although separate by Water, they were supposed to belong, as to *Europe*, *Asia*, *Africke*, *America*, or *Magellannica*, or some other as *Geographers* haue reduced them. Secondly, because it was a bold coniecture to thinke the whole world to consist only of those parts, found out in *Strabos* time: For besides the two parts of *America* since that time discovered by *Columbus*, another great portion is since that time found out in the South, by the coniecture of *Ferdinand de*

Quir, comming neere the quantity of *Europe*, *Asia*, and *Africa*. Which howsoever it be round enuironed with sea, and therefore might seeme an Island, yet in respect of the greatnes of it, and the many regions and kingdomes it containes, it may well bee reputed a continent: To which many lesser Islands belong.

I It is probable that Islands were not from the first creation, but were made afterwards either by the vniuersall deluge, or some other violence of the Water.

It hath been the opinion of diuerse learned men, that Islands were not onely before the Flood, but from the first creation of the world: because they seeme no lesse to make for the ornament of the Earth, then diuers Lakes and Rivers dispersed on the Land. But this argument seemes very weak: first because a greater ornament seemes to consist in vniformity then confusion; besides, the ornament must not bee measured by our phantasie, but Gods Almighty pleasure and will expressed in his owne workmanship: and that hee created Islands in the beginning, is the thing in question. That Islands were not from the Creation, many probable reasons are alleaged: First from the words in the 1 of *Genesis*: *Dixit verò Deus, congregentur aque quæ sub cælo sunt, in locum vnum, & appareat arida: & factum est ita; & vocauit Deus aridam, terram; congregatio- nesq; Aquarum appellauit maria.* By which may be collected, that the waters were gathered together in their own place, by themselves, and therefore had no such intercourse betwixt Land and Land as now they haue, admitting Islands: wherefore it is more probable, that such Islands as now appeare were either caused by that Vniuersall Deluge of *Noah*, or by some other Accidents: for it is most certaine that the Sea on the Land some-where gaines, and other-where in recompence of it, it looseth againe: as may appeare by the 14 of *Genesis*; where it is said of the comming together of certaine Kings: *Hi omnes conuenerunt in uallem Synefrem, quæ nunc est mare salis*

salis: out of which it is evident that that parcell of ground which was a woody place in the time of *Abraham*, was before the time of *Moses* become the Salt Sea. Many examples of the like are given vs by *Pliny* in his Naturall History, which we shall haue occasion to vrge hereafter. And therefore it is no hard thing to belieue, that since the first beginning of the world all Ilands might bee produced in this sort. Another argument by which they would establish this opinion, is that wee see almost all Ilands of the Earth not onely inhabited of mankind, but also furnished with diuerse kindes of Beasts, some tame, some wilde, some wholesome, some venomous, some vsfull, some altogether vnprofitable. Now it seemes very unlikely that men being in elder times, and now also in most places of the Earth, altogether vnskillfull in the Art of Nauigation, should venture so farre on the maine Ocean, to people Countreies so far distant; sith at this day, wherein Nauigation is arrived at a great perfection, hauing the helps both of the Chart and Compasse, altogether vnknowne vnto the ancients, wee see most Nations very scrupulous in searching out farre remote Countreies. But admit this were overcome by mans Indultrie, which no doubt is much increased by Necessity; yet cannot it bee ver / probable, that so many sundry kindes of beasts should in this sort bee transported: for howe soeuer wee coniecture concerning such beasts as necessarily serue for mans sustenance; yet seemes it hard to thinke that man should bee so improuident and enuious to the place of his own Habitation as to transport rauenous, venomous, vnwholesome, and vnprofitable creatures: for by no other meanes but by transportation can such beasts bee imagined to bee brought into Ilands: For the first originall of all creatures in the Creation was in or neere *Paradice*, which wee shall proue to haue been in the Continent of *Asia*; the second Seminary was in the *Arke*, which by the testimony of the Scriptures was first disbursed in the same Continent. How from hence they should spread themselves into Ilands, is the doubt. Impossible it seemes they should swimme so far; for what Creature will venture it selfe on the maine Ocean being by a naturall instinct

instinct fearefull of death, and carefull of his owne preferuation: Whence it is more likely to imagine, that these parcels of land being first furnished with such creatures, were afterwards by the violence of the flood, or some other like Accident, torne off from the maine Continent, retaining still such Creatures as it had before. But here *S. Augustine* seeme to avoid this Argument two wayes: It is not (saith he) incredible, that wild and savage beasts might bee transported from one Countrey to another by Sea: either by Men for the delight of Hunting; or else by the helpe of Angels by Gods Commandement, or at least permission. This answer seemes very probable as well for it selfe, supposing nothing impossible to Almighty God, as also for the authority of the Author. But with all reuerence to the Authour, whom all the Christian Churches are bound to honour, this assertion is not so strongly fortified to enforce assent. And first it is not very likely that pleasure with men should so farre ouersway the generall weale and profit, as to transport so many rauenous and hurtfull beasts; for meere hunting sports and recreation. Secondly, the chase of some, as *Lions*, *Leopards*, and such like, hath more danger in it then sport or delight; and if so be these were conueyed ouer Sea for such ends, yet it is very probable, they would keepe them rather close and imprisoned to serue occasion, then to let them loose and free for farther propagation. Finally, whereas hee ascribes the transportation of them to the ministry of Angels; no man can deny but this may bee possible; because by their permission of Almighty God they might effect greater matters. Yet seemes this not so likely as the other, because wee finde that in the generall preservation of all creatures in the Arke, hee vsed the ordinary helpe of Naturall meanes, although directed and assisted by a Diuine power: And of God effected greater matters in this sort, why may wee not belieue it of things of lesser moment and necessity? But of this wee haue spoken before. Another reason for our opinion that Islands were not before the flood, or at least from the Creation, is urged by *Versteegan* a late Writer in this manner: There is nothing broken) (saith he) that hath not bin whole:

whole; which he sets downe as an infallible principle: for howbeit Nature doth sometimes against her own intent commit some errors, in so much as the things formed haue either too much, or too little; yet bringeth she forth nothing broken, or disseuered; but such as it is, it is alwayes whole and not broken, except afterwards by some accident. And if Nature, the hand-maide of God, neuer misleth this perfection, much more ought wee to belieue that God the Father of Nature in the first Creation left no part thereof broken and vnperfect. But euery man may see by ordinary obseruation, that the *Clifts* and *bounds* of the Sea (as not being by God in the creation so formed) seeme not onely seuered and broken, but (as it were) cut *streight* and *steep* downe from the top to the bottom, not sloping or declining by degrees; as wee see in *Island Hills* in their descent vnto the valleyes. The forceable breach of the land (as wee pretend) by the Sea fretting through some narrow place, seemes the more to be confirmed in that we find it not steep towards the Land, where the Land declines by a sloping descent as in other places; but rather towards the Sea in such sort, as both the sides of a narrow and streite Sea oftentimes in the nature of the soile, and conformity of figure, seeme to answer one other; onely shewing the want of substance betwixt them which is lost. It may hence be objected that many other hills and rocky places of *Iland Countreyes*, seeme in like manner as broken and steep downe as these *clifts* bounding the Ocean: as also that the *clifts* towards the Sea are broken higher vp then any waies the Sea could be imagined to ascend. To this wee answer, first that rocks on the dry land many times seeme broken, when indeed they are not, being by Nature fashioned craggie and vneuen. Secondly, whereas Hills in *Inland countreyes* seeme broken, this might proceede heretofore by Earthquakes which haue oftentimes beene obserued to produce such effects as it hath lately beene knowne to doe in a Towne called *Pleurs* in the *Grisons Countrey* neere the *Alpes*: and for the appearance of such breaches in the tops of *clifts* aboue the ascent of the waters, it might be caused by the violence of the Sea-waues, fretting and eating

out

out the sides of them beneath the bottome; whence it happens that the higher part for want of vnder-propping must needes fall and breake off from the other. This Argument of our said Authour is by him back't with another, drawne from the name of a *cliffe*, which in our aeneient language is drawne from cleaving or breaking off: which appellation is neuer giuen to our Inland Hills, but only to such as terminate and compass in the Sea. These reasons make the matter seeme probable; yet condemne I not the other as absurd, because it may probably be defended, and backt with the authority of many graue Authors.

4 A second Distinction ariseth out of the termination of the Land with the Sea: For either it is *vniforme* or *various*.

5 An vniforme termination I call that which without any notable difference inclines more to euennesse and Regularity.

It is manifest that the Sea-waves working on the Land violently, and not naturally, seldome or neuer so bound and compass the Land, as to reduce it to a regular and perfect figure. But yet because in some places it comes somewhat neere to such a figure, somewhere it is very farre off; wee thought it fit to insert this distinction. This inclination to a Regular figure is some-where square, consisting of Right-lines, some-where circular; an example of the former we haue in *Spain*, which on the North-side, and the West is bounded more streitly, coming neere a right-line: of the other in *Africke*, whose North-West side from the *Mediterranean* streits to *Guinea* seemes in some sort circular.

6 A various Termination is that wherein the bounds are crooked, and as it were indented with crekes and turnings. Here three things

things are remarkable. 1. *Peninsula*, *Isthmus*, and *Promontorium*.

- 7 A *Peninsula* is a part of land euery where enuironed with the sea, excepting in one part, where it is knie vnto the maine land: An *Isthmus* is a narrow land betwixt two seas: A *Promontorie* is a high mountaine bending it selfe into the sea: the head Whereof is called a *Cape*.

These three are remarkable accidents growing out of the Termination of the land with the sea, and belonging as well to continents as Ilands. The first we call *Peninsula*, *quasi pen. Insula*; termed of the *Gracians Chersenesus*, although I find this name oftner giuen to the *Isthmus* than the *Peninsula*. Amongst the *Peninsula's* the most famous are *Africa*, *Scandia*, *Taurica Chersenesus*, *Peloponnesus*, and *America Peruviana*. That little parcell of land which ioynes this *Peninsula* with the maine land, we call an *Isthmus*; which is a narrow necke of land betwixt two seas, ioyning two Continents; such as are *Isthmus Corinthiacus* and *Isthmus Cimbricus*: more famous are those two narrow lands, whereof the one lyeth betwixt *Peruviana*, and *Mexico* in *America*, the other diuiding *Africke* from *Asia*. A *Promontarie* is a great mountaine stretching it selfe far into the sea: whose extremity is called a *Cape* or *Head*, of which the most remarkable are the *Cape of good hope* in *Africke*, 2. The *Cape of S. Vincent* in *Portugall*, 3. The *Cape of Comary* in *Asia*. 4. The *Cape de la Victoria* in *America*. Our obseruation concerning this distinction shall bee comprised in this Theoreme.

1. *Peninsula's* by the violence of the sea fretting through the *Isthmus*, haue oftentimes beene

bee turned into Ilands: and contrariwise sometimes Peninsula's by diminution of the sea made of Ilands.

This proposition is not hard to proue, if any credit ought to bee giuen to ancient writers: for it is commonly related, that *Sicily* was heretofore ioyned to *Italy*, *Cyprus* to *Syria*, *Eubœa* with *Boeotia*, *Besbicum* with *Bythinia*; all which at this day are Ilands separated and diuided from the continent. The like hath beene coniectured of our *Brittany*, which some imagined heretofore to haue beene ioyned with the continent of *France*, about *Douer* and *Calais*: as may seeme probably to be gathered out of the correspondency of the *Cliffs* (whereof we haue spoken in this chapter before) the agreement of the soyle, the smalnesse of the distance, and many more arguments remembred by vs else-where. Also it hath beene obserued on the other side, that the sea in some places leauing his ancient bounds, hath ioyned some Ilands to the land, making *Peninsulas* of Ilands. In this sort if wee belieue antiquity was *Antrissa* ioyned to *Lesbos*, *Zephirium* to *Halicarnassus*, *Erhusa* to *Mindus*, *Promiscon* to *Miletum*, *Narthacusa* to the *Promontory* of *Parthenius*: In these antiquities it behooues euery man to iudge without partiality, according to reason, not ascribing too much to fabulous narrations, wherein those ages did abound, neither yet shewing himselfe too incredulous: For as much as we cannot charge these Authors with any manifest absurdity. The speciall and particular arguments by which wee should establish our assertion, wee must according to the rules of method reserve to the speciall part, where we shall treat of speciall Countreyes.

CHAP.

C H A P. XII.



F the perpetuall Accidents of the land, we haue spoken somewhat: it remaines in this place wee treat of the Casuall.

- 2 The casuall I call such as happen not ordinarily at all times : such as are *Inundations* and *Earth-quakes*.
- 3 An *Inundation* is an ouerwhelming of the land by Water.

Howsoeuer it bee certaine out of holy Scriptures, that God hath set the sea his certaine bounds and limits, which it cannot passe: yet the same God sometimes to shew his speciall iudgement on some place or age, hath extraordinarily permitted the sea sometimes to breake his appointed limits, and invade the Iurisdiction of the land. This wee call a Deluge or Inundation. The Inundations which euer haue been obserued on the Earth, are of two sorts, either Vniuersall or particular: An vniuersall is that whereby the whole face of the Earth is couered with water; whereof we haue onely two examples: The first was in the first creation of the world, when (as wee read in the Scriptures) the whole face of the Earth was round inuoloped with Water, which couered the tops of the highest mountaines, till such time as God by a supernaturall hand, made a separation of the Waters from the dry land: But this is improperly called an Inundation, because, the same properly taken implies as much as an ouer-flowing of that which was dry land before: The second (as we read in *Genesis*,

sis) happened in the time of *Noah*, when God for the sinne of man, drowned the whole world, breaking open the cataraets of Heauen, and loosing the springs of the deepe. Particular inundations are such, as are not ouer the whole Earth, but in some particular places or regions; Such a deluge (according to *Genebrardus*) happened in the time of *Enos*, wherein a third part of the Earth was drowned. The like is spoken of *Ogyges* King of *Athens*, that in his time happened a very great Inundation, which drowned all the confines and coasts of *Africa* and *Achaia* euen to the *Aegæan* sea: In which time it was thought that *Buras* and *Helice* Cities of *Achaia*, were swallowed vp; whereof *Ouid* in his *Metamorphosis*, speaks thus.

Si queras Helicen & Buran Achaidos vrbes.

Inuenies sub aquis:

Buras and *Helice* on *Achaia* ground

Are sought in vaine, but vnder seas are found.

As famous was the Inundation of *Thessaly* in *Deucalion* time mentioned not onely by profane writers and Poets, but also by *S. Augustin*, *Ierom*, and *Eusebius*, which would haue it to happen in the time of *Cranus*, who next after *Cecrops* gouerned *Athens*. This inundation was exceeding great, extending it selfe not onely ouer all *Thessaly* and the regions adioyning westward, but ouerwhelmed the greatest part of *Italy*. The same or other happening neere the same time, oppressed *Egypt*, if *Eusebius* may obtaine credit. Hence some would haue the people of *Italy* to haue been called *Umbrii* (as *Pliny* and *Solinus* report) *quia de imbris diluuij superfuissent*. But this *Etymologie* seemes too farre fetched. There are also two other notable Inundations mentioned by ancient writers, which fell out in *Egypt* from the River of *Nilus*, whereof the first couered all the neither *Egypt*, which was subject to *Prometheus*, and hence (as *Naturalis Comes* obserues) was the fable drawne of the vulture lighting on *Prometheus* liuer, afterwards slaine by *Hercules*. For (as *Diodorus Siculus* obserues) the River *Nilus* for the swiftnes of his course was in ancient time called an *Eagle*. This River afterwards did *Hercules* by his

his great skill and iudgement streiten and bound, reducing it into narrow channells: whence some Greeke Poets turning *Hercules* labours into fables, faigned that *Hercules* slew the *Eagle* which sed on *Promethæus* breast, meaning that hee deliuered *Promethæus* out of that sorrow and losse which hee and his people sustained by that Inundation. The second of these *Egyptian* floods happened about *Pharus* in *Egypt*, where *Alexander* the great built *Alexandria*. To these may bee added many more of lesse moment, as well in ancient times as in our dayes: As that of *Belgia* in some parts mentioned before, on another occasion; and not many yeeres since in some parts of *Somerset-shire* with vs in *Britanny*.

I No vniuersall Inundation of the Earth can be Naturall: The other may depend on some Naturall causes.

Of the causes of Inundations many disputes haue beene amongst Naturall Philosophers: some haue trusted so farre to Nature, that they haue ascribed not only particular Inundations, but that vniuersall Deluge in the time of *Noah* to second causes: of this opinion was *Henricus Meelienfis* a Schollar of *Albertus Magnus*, who in his Commentaries vpon the great Coniunctions of *Albamar*, obserued that before *Noahs* flood, chanced a coniunction of *Iupiter* and *Saturne* in the last degree of *Cancer*, against the constellation since termed *Argo's ship*: out of which he would needs collect, that the flood of *Noah* might haue beene fore-showne; because *Cancer* is a watry signe, and the house of the *Moone* being mistress of the Sea, and all moist bodyes according to *Astrologie*: which opinion was afterwards confirmed by *Petrus de Alliaco*, who affirms in his Comment vpon *Genesis*, that although *Noah* did well know this flood by diuine Reuelation; yet this coniunction being so notable, hee could not bee ignorant of the causes thereof; for those were not only signes, but also apparant causes by vertue receiued from the first cause, which is God himselfe. Further to confirme this assertion hee would haue *Moses* by the *variations* of Heauen, to haue meant the

the great & watry coniunction of the Planets. A reason whereof hee seemes to allege, because it is likely that God would shew some signe in the Heauens, by which all men might be warned to forsake their wicked courses. But notwithstanding this curious opinion, I rather cleaue to those which thinke this Deluge to be meereely Supernaturall, which I am induc'd to belique for diuers causes vrged by worthy writers. First, because this is set downe in Holy Scripture for a chiefe token or marke of *Noahs* extraordinary faith & dependance vpon Gods promises: which had been much diminished, and of small moment, had it any way been grounded on the fore-sight of second causes. For this was no more then might haue beene discovered to the rest of the wicked worldlings, who no doubt would in some sort haue provided for their safety, had they receiued any firme perswasion of this dreadfull Deluge. To which others adde a second reason, that second causes of themselves, without any change or alteration, are not able to produce such an admirable effect as the drowning of the whole World: for it is not conuenient (say they) that God the Author of Nature should so dispose and direct the second causes, that they might of themselves bee able to inuert the order of the Vniuerse, and ouerwhelme the whole Earth, which hee gaue man for his habitation. But this reason is thought very weake, for as much as it seemeth to imply a new creation: The conceit of a new Creation is pronounced by a learned Countreyman of ours, both vnlearned and foolish: for whereas it is written (saith hee) that the fountaines of the deepe were broken open, it cannot otherwise be vnderstood, then that the waters forsooke the very bowels of the Earth, and all whatsoever therein was disperfed made an eruption through the face of the Earth. Now if wee compare the height of the waters in this deluge about the highest mountaines, being onely 15 cubits, with the depth of the semi-diameter of the Earth to the Center, we shall not find it impossible, answering reason with reason, that all these waters disperfed vnder the Earth, should so far extend as to drowne the whole Earth: for the semi-diameter of the Earth (as *Astronomers* teach) is not about 3500 miles.

miles, wherein the waters contained and dispersed, may bee sufficient for the hight of the greatest mountaines, which neuer attaine 30 miles vpright: whereas this distance of 30 miles is found in the depth of the Earth 116 times. Secondly, the extension of the Ayre being exceeding great, it might please God to condensate and thicken a great part thereof, which might concurre to this Inundation. We willingly assent to the worthy Authour, that this Inundation might bee performed without any new creation: Notwithstanding we cannot hence collect that it was Naturall. But to compose the difference the better, and to shew how far Nature had a hand in this admirable effect, we will thus distinguish; that an effect may be called Naturall two manner of wayes: First, in regard of the causes themselves: Secondly in respect of the Direction and Application of the causes. If we consider the meere secondary and instrumentall causes, wee might call this effect Naturall, because it was partly performed by their helpe and concurrence. But if we consider the mutuall application and coniunction of these second causes together with the first cause, which extraordinarily set them a worke, we must needs acknowledge it to be supernaturall. For other particular Inundations in particular Regions we may more safely terme them Naturall, as directed and stirred vp by second causes, working no otherwise, then according to their owne naturall disposition. Two causes concurring together, are here most notable, whereof the first is the great coniunction of watry Planets working on the water their proper subiect: the other the weaknes of the bounds and banks restraining the water, which by proesse of time weare out and suffer breaches: both these causes sometimes concurring together, cause an Inundation: which assertion wee may lawfully accept, but with this caution, that Almighty God working by second causes, neuertheless directs them oftentimes to supernaturall and extraordinary ends.

2 *Particular alterations haue happened to Bounds of Regions by Particular Inundations.*

How soeuer some inundation haue not continued long, but after a small time left the Earth to her owne possession; yet others haue been of such violence, as they haue beene found to haue fretted away, or added, and so altered the bounds and limits of places: which besides diuerse examples produced by vs, in our former chapter. *Aristotle* seemes to acknowledge in the 1 booke of his *Meteors*, the 14 Chapter, where he saith, that by such Accidents sometimes the *Continent* and firme land is turned into the Sea, and other-where the Sea hath resigned places to the Land: for sith the agitation or moving of the water depends ordinarily vpon the vertue of Heauenly bodyes, if it should happen that those Starres should meet in coniunction, which are most forceable and effectuell for stirring vp of Tempests and Flouds, the Sea is knowne to rage beyond measure, either leauing her ancient bounds, or else vsurping new. By this meanes (as we haue shewed in the former Chapter) some Ilands haue been ioyned to the Land, and some *Penninsulas* separated from the Land, and made Ilands: some-where the Sea hath beene obserued for a great space to leaue the Land naked, as *Versagean* coniectures of the most part of *Belgia*, which hee sayes, was in ancient time couered with water; which besides many other arguments hee labours to protee out of the multitude of fish-shells, and fish-bones, found euery-where farre vnder ground about *Holland*, and the coasts thereabouts, which being digged vp in such abundance, and from such depths, could not (saith hee) proceed from any other cause then the Sea, which couered the whole Country, and strewed it with fishes. Lastly, that the Sea might seeme as well to get as lose, shee hath shewed her power in taking away and swallowing vp some Regions and Cities, which before were extant: Such fortune had *Pyrrha* and *Anrissa* about *Meoris*, *Helice* and *Bura* before mentioned in the *Corinthian* straites: some haue beene of opinion that the whole *Mediterranean* within *Hercules* pillars, was in time past *habitable land*, till it gaue way to the violency of the Seas inuasion: But in this I credit nothing without farther ground. The like vncertainties are also related of the *Atlantick* Ilands, greater

greater then all *Africa*, swallowed vp of the *Ocean*: which *Columbus* was said in a sort to haue discovered in the Sea, finding a great shallow fraught with weedes, where he supposed this great Iland to haue stood. But I rather belecue that this *Atlantick* Iland spoken of by *Plato*, was either a Poeticall fiction, as *Moor's Utopia* with vs, or at least the Continent of *America* perhaps in those dayes obscurely discovered, but the discovery lost againe to after ages.

- 3 *Certaine Regions by reason of great Riuers are subiect to certaine Anniuersary Inundations, which commonly happen betwixt the Tropicks in the Summer, without the Tropicks in the Winter.*

The former clause is proued by experience almost in all great Riuers in the world, which at some times of the yeere swell higher, ouerflowing their bankes, and drowning a part of the land about them. But this happens not alike in all places; for in Riuers included within the Tropicks, as *Nilus & Niger* in *Africa*, and *Oregiana* in *America* with others there-about, this *Anniuersary* Inundation, is in the Summer, else-where it is commonly in the *Winter*. For the former these causes may be assigned; 1 The melting of the snow on the tops of the great mountains in those parts, which is greatest of all, when the Sun is neereft or verticall vnto them, which we are to accompt their Summer. 2 The daily raines & showres such Regions are subiect vnto; These showres are much more frequent & greater when the Sun is neereft their verticall point or in it: The reason whereof we haue formerly shewed to bee this: That the Sun daily in those parts drawes vp more vapours, then he can dissipate & consume: Whence meeting with the cold of the middle Region of the *Aire* they are condensated into drops, & so turned into raine. For the later case in riuers sitat without the Tropicks, comonly happens the contrary, to wit, that such Inundations happen rather in the winter then in the Summer,

whereof these reasons may bee rendred. 1. Because *Raine* and *showres* whereof such ouer-flowing are ingendred in those parts, are more frequent in winter then in the Summer. 2. whereas neere the *Equator*, the *snow* is known to melt with the *Sunne* from the tops of high Mountaines, in other parts it seldome or neuer melts at all, (as may bee thought (vnder the *Pole* or thereabouts; or else, if it melt, it happens, (as in the temperat Zones we see it doth) oftner by *raie*, then the heat of the *Sunne*.

4 Next are we to speake of *Earthquakes*: An *Earthquake* is a sensible motion and shaking of the parts of the Earth.

Amongst other remarkeable affections of a place, which are not so ordinary, an *Earthquake* hath no small consideration, being oftentimes a meanes which God vseth to shew some great and extraordinary iudgement. But not to spend more on this subject then may seeme meete for *Geography*, wee will shew the *causes* and *kindes* of it, by which we may the sooner come to learne what *Regions* and places of the Earth are most subiect to this affection, which is necessary of a *Cosmographer* to bee knowne. Concerning the *causes* of it, much dispute hath been among *Philosophers*: some haue ridiculously affirmed, that the Earth is a liuing creature, and suppose with no lesse, if not greater absurdity, that the Earth being in good temper, doth rest & settle quietly according to her naturall disposition: From which temper if she be any way removed, as if she were sicke, or pain'd in some part, she shakes and shivers. The relation of this opinion is a sufficient confutation. *Thales Milesius* would haue the Earth as a *shippe* to swimme on the *Waters*, which being sometimes as a vessell by tempests turned on one side too much, it takes a great quantity of water, which is the cause of *Earthquakes*: But this opinion is a poetick fiction. Little more probable is the opinion of *Democritus*, that the Earth drinking in *raie* water more then her cauernes can well containe, the water reuerberated

reverberated backe is cause of such a motion: But who can imagine that drops of raine falling into the Earth can bee reuerberated backe, with such violence to cause such an extraordinary motion of the Earth? *Anaximenes Milesius* was of opinion that the Earth her selfe was cause of her own motion; for the parts of it being taken out (as it were) and broken, fall downe sometimes into a great depth, causing the vpper face of it to shake and tremble; to which opinion also *Seneca* seemes to subscribe in the sixth booke of his naturall questions the 10 chapter; To which also accords the Philosophicall Poet *Lucretius* in these words.

*Terra superna tremis magnis concussa ruinis,
Subter ubi ingentes speluncas subruit atas,
Quippe cadunt toti montes, magnosq; repente
Concussu late dispergunt inde Tremores,
Et merito: quoniam planstris concussa tremiscunt
Testa viam propter non magno pondere tota.*

The vpper Earth seiz'd with great ruines shakes,
When furrowed age her vast ribbes ouertakes.
For mountaines great fall downe, and with the blow
The Tremblings are dispersed to and fro.
Not without reason; when a small-fiz'd waine
Makes houses neere the way to shake amaine,

This last opinion seemes to carry more shew of probability then the former; neither can any man deny, that sometimes the Earth in some parts, may shake by the breaking downe of some *subterranean* parts, whose suddain and violent motion may cause the rest being continuat to entertaine the like commulsion. But yet more generall seemes the opinion of *Aristotle* who would haue *Earthquakes* to proceed from a *spirit* or vapour included in the bowells of the Earth, as he testifies in the 2 of his *Meteors* the 7 chapter. For this vapour finding no way to passe out, is enforced to returne backe; and barred any passage out, seekes euery corner: and while it la-

bours to breake open some place for going forth; it makes a tumultuous motion, which is the *Earth-quake*. Now least it should seeme improbable that to great a masse of Earth should bee moued, and shaken, by so thinne and rarefied a body as is a fume or vapour; *Aristotle* in the same place shewes the admirable force of Winds as well vpon the *Aire*, as on the bodies of living creatures: In the *Aire*; because experience shewes that being stirred vp by a *Windy vapour* it sometimes is knowne to moue rockes from one place to another, to plucke vp trees and shrubbs by the rootes; and sometimes to throw downe the strongest and most stately buildings: In *mans body*, because by the stirring vp and agitation of the spirits, which are the Instruments of vitall and animall functions, sometimes one sicke man can doe that, which cannot bee performed by many stronger and abler men; as it hath beene tried sometimes, that a *Franticke* man hath broken very strong chames, wherwith he hath been bound; which many other men could not doe. Neither on the other side, can it seeme strange, that many and great exhalations, vapours, and spirits should be ingendred vnder the Earth; For as much as the Earth is heated many wayes. Many wayes may bee specified whence such fumes should arise; as, first, from the Sunne and Startes; Secondly, from the subterranean fires hid in the bowels of the Earth; Thirldly, in the winter-time by an *Antiperistasis*, the heat collecting it selfe downeward to the inner parts of the Earth, which was before in the outward parts of it: The argument by which *Aristotle* would confirme this opinion, is drawne as well from the *time*, as from the *places*, wherein Earthquakes vsually happen: from the *time*; because then most Earthquakes are obserued to bee, when most *exhalations* are inclosed in the bowels of the Earth; to wit, in the *Spring-time* and the *Autumne*. From the *places*; because, for the most part *spongie* and hollow Regions, which may drinke in a greater quantity of exhalations, are commonly most subiect vnto it: for although many exhalations are dayly inclosed in the wombe of the Earth, yet Earthquakes fall but seldome; because the matter is seldome so strong and violent as to shake the

the Earth: Wherefore some *Philosophers* haue expressed three principall wayes which make this *Earth-quake*: first, when a great quantity of exhalations is suddenly ingendred, which for the greatnesse of it cannot be contained in so little a space: for then being almost choked, it seekes a way to fly forth: Secondly, when the Earth is condensed by cold, and drives the exhalation from one place to another, which flying hither and thither, shakes and strikes the Earth: Thirdly, when the exhalation, the cold compassing it round by an *Antiperistasis*, begets heat within it, and so is rarified: for so being vnable any longer to confine it selfe to its former place, it breakes forth, and so shakes the Earth: We must here note by the way, that not onely exhalations are cause of the distemperature in the Earth, but also *subterranean fires* and *windes*: all which by some are iudged to bee of equall force in this action: for the diuision of Earthquakes so farre forth as it concerns the difference of places, we must vnderstand, that it may be either *Vniuersall* or *particular*: An *Vniuersall* Earth-quake is that which shakes all the whole Earth in euery part, at least in the vpper face: whereof (I suppose) no *naturall* cause can be giuen, but the *immediate* and miraculous power of God: such an Earth-quake happened at the time of our Saviours Passion, whereof *Dydumus* a graue and ancient Writer left record. But that which is said to haue happened in the time of *Valentinian*, mentioned by *Orosius* in his 7 booke of Histories, & 32 Chapter, is thought by graue Authours to be no *vniuersall* Earth-quake, howsoeuer for the large extent of it, it was thought to be generall. A *particular* Earth-quake is that which is bounded in some one or more particular places, which for the causes before-alleged cannot be so far extended, because the cauerues and conuexities of the Earth, where such vapours and exhalations are contained, cannot bee ordinarily so great as to extend to many Kingdomes and Regions.

1 Regions extreame cold or extreame hot are not so subject to Earth-quake as places of a Middle

Middle temper.

The reason is, because in places extreame *cold*, exhalations are not so soone ingendred, and in so great a quantity as in other parts: on the other side in places which are extreame *hot*, the exhalations which are bred, are soone consumed with excessse of heat: both which may be confirmed by Instances. It is obserued that in the cold *Northerne* parts (as *Olaus Magnus* writes in his 10 booke and 13 Chapter) Earthquakes are very seldome or neuer: so it is obserued by *Pliny* in his 2 booke and 18 Chapter: and *Albertus Magnus* in his 3 booke of *Meteororum* tract. 2: That places which are very *hot*, as *Egypt*, are seldome troubled with this shaking of the Earth: whereas places betwixt both, which are seated in a more temperat climate, find it not so strange.

1 *Hollow and spongie places are more subiect to Earth-quakes then solide and compacted soyles.*


We must here vnderstand that *hollow* places are either such as lye open to the Aire, or are hollow onely vnder, and close vpward. The former sort are not at all subiect to the molestation of *Earth-quakes*, because the *exhalations* fly out without impediment: but the latter being more apt to ingender and retaine such matter, must of necessity bee more troubled: This is most plainly obserued in *Phrygia*, *Italia*, *Caria*, *Lydia*; wherein such motions are more frequent. To confirme this a little farther, wee obserue that *hilly* and mountainous places, suffer this violence oftner then other parts; because there most commonly caernes and concanities are more frequent then in plaine countreyes. But here by the way may bee objected, that *sandy* and slimy countreyes are many times more free from Earth-quakes then other places: an instance whereof was giuen before in *Egypt*, wherein neuer any *Earth-quake* (as most Authours affirme) or at least but one (as *Seneca*) hath beene obserued. The reason may bee giuen, that *sandy* places without any strife suffer the exhalations to disperse themselves: that

that slimy places want sufficient receptacles to enterrayne them.

3 *Ilands are more often troubled with Earth-
quakes then the Continent.*

This haue they found to be true in many *Ilands* of the *Mediterranean Sea*. and others also chiefly in *Cyprus*, *Sicily*, *Eubœa*, *Tyrus*, *Angria*, *Lippora*, and the *Molucco Ilands* betwixt the *East* and *West-Indies*. The cause some would haue to bee the *Antiperistasis* or *circumstancy* of the waters, which is apt to engender greater store of exhalations in the Earth. But neuertheless that *Ilands* are more subiect to *Earth-quakes* then *Continents* I dare affirme no otherwise then probable; because some places in the Continent seeme very much affected, especially in *Europe*, aboue other places, *Constantinople* and *Babylonia*, if we credite authors which haue written of this matter; in *Asia*, *China*, and other Regions adioyning thereunto.

C H A P. XIII.

1  He *Naturall Affections* of the Land haue hitherto beene declared: Wee are in the next place to treat of the *Ciuill*: Those wee terme *Ciuill* which concerne the *Inhabitants*.

2 *An Inhabitant is a man dwelling in a certaine place.*

The name of an *Inhabitant* (as we haue before noted) may be taken either generally for any living creature, residing in a certaine place, in which sense *Beasts* may be called *Inhabitants*: which signification is only *metaphorical*: or else for a

Bea-

Reasonable living creature, whose abode is settled in any place or Region, in which sense we here take it. The consideration of the *Inhabitants* we have reserved for this last Treatise; following as well the methode of the first creation, as of *Moses* in the narration. For God proceeding in the first Creation according to the order of Generation. From the more vnperfect to the perfect; created not man before such time as he had furnished the Earth with all things agreeable and necessary for his use; to which alludes the Poet in these Verses.

*Sanctius his animal mentisq; capacius alia
Decorat adhuc, & quod dominari in cetera possit,
Natus homo est.*----

More sacred and of vnderstanding minde,
A creature wants to gouerne euery kinde;
So man beguane

Of the *Nature*, *Proprieties*, *Dignities*, and other accidents of this principall creature, there wants no discouery; sith large volumes are stuffed with this theame, and euery man which knowes himselfe can preuent me in this subiect: I will here speake of him so farre forth as hee is an *Inhabitant* or dweller on the Earth.

3 In the *Inhabitants* wee are to consider two things: either the *Originall*, or the *Disposition*.

41 The *Originall* is the off-spring whence all *Inhabitants* tooke their beginning.

Concerning the originall of people of the Earth, wee are to obserue two things; First, the *Distinction* of originall; Secondly, the *Order* of inuention. For the first, wee must note that all *Inhabitants* of the Earth, haue a *three-fold* originall or beginning. The first was from the first Creation, the second was immediately after the generall deluge, wherein all the *seminary* of living creatures was preserved in the Arke: The third, is the first stocke or originall of each seuerall Nation: For this last, it is a matter which wee cannot here so well de-

fine,

fine, till wee come to the particular description of each Region, to which it properly belongs. It shall bee enough in this generall part, to speake of the two first, as far as approoved History and Obseruation shall direct vs: For the Manner of finding out the originall of Nations, these rules are giuen vs by *Bodin* in his ninth chapter of the *methode of History*. The first is by the testimony of approoved Authōrs. The second is by the markes and footsteps of Languages. The third may be drawn from the Limits and knowne bounds and situation of Countreyes. This knowledge of the Originall of Nations, hath been a matter of no small importance: For (as *Bodin* obserues) there is nothing which hath more exercised the wits of Writers, or caused more ciuill discords and ruines of diuerse common-wealths, then the contention about the first originall of nations: which iarres and contentions (as I take it) spring from no other ground then the naturall pride in the minds of men, and the affection of Nobility: whereby it often comes to passe, that such men as haue risen to greatness, by their Wealth, Villanies, or other such like meanes, haue afterwards, to continue and bolster vp their vsurped dignities, sought out new pedegrees and Ancesters, to set a glosse vpon their owne base beginnings; a humor in our dayes more affected, then prayse-worthy; not only of priuate persons, but of whole nations, which run far off to seeke out their first originall, which with more ease and certainty, they might find neerer home. To let passe other examples we need goe no farther then the *French* and the *Briuanes*, both which labour as much as may be, to deriue their first originall from the *Troians*. The first from the lineage of *Hector*, the other from *Aeneas*; as if more glory were to be deriued from *Troian* fugitiues, then from the valiant nation of the ancient *Gauls* and *Germans*, from whom they might deriue a truer and a more certaine descent. The consideration of this antiquity of nations so far forth as it concerns our *Geographical* discourse, reseruing matters of more specialty to our *Speciall* part, wee will comprise in these Theoremes.

All Nations had their first originall from one stocke, whence afterwards they became divided.

Wee must here vnderstand (as wee haue before noted) that all Nations haue a threefold originall, the first before the vniuersall deluge, the other soone after, the later long after. For the first, no doubt can bee made by such as credit the truth of holy Scriptures, but it was from *Adam* the first father of mankind; For the last, it is doubtfull and various, and therefore cannot well bee handled in generall, before wee come to the description of particular countryes; where we are determined to make a search as neere as can be into their originall. But that which we chiefly here note in the second offspring of mankind soone after the flood: For certaine it is that all mankind was confined to the family of *Noah* in the *Arke*; so that their first originall must be drawne from the *Arke*; and that place where the *Arke* rested, presently vpon the falling of the waters: which we shall proue to be far Eastward. Hence is the manifold arrogancy of many nations well discovered; for amongst the Ancients some haue so much affected the antiquity of their race, that forgetting their humane condition, they haue deriued their nobility from the gods. Which humour hath not onely invaded the minds and affections of foolish and ignorant men, but also of such as haue stood in great opinion & estimation of wisdom and vertue: In so much as *Cesar* in a certaine oration to the people of *Rome*, was not ashamed to boast, that he was descended by his Fathers side from the gods, by his mother from Kings: As also *Aristotle* deriued his offspring from *Apollo* and *Esculapins*: which strange affectation was little lesse in the people of lower and baser condition, who either being vtterly ignorant of their owne offspring, or at least dissembling it, for the hate they bore to strangers haue called themselves *Auroy-Doräs* which is as much to say, as a people bred of the same region, not fetching their descent from any other nation: In which sense *Aristides* in *Panathenaeum* giues the greatest nobility to the *Athenians*; to wit that being borne of the Earth the mother of the gods, they deriued

riued not their descent from any other forraigne countrey: and this error is obserued not onely amongst the Ancient, but also with the newer writers, to bee so common, that *Polydore Virgill* otherwise a prudent writer, affirms the *Britaines* to bee a people taking their originall from the Iland Countreys, and not deriued farther. The like is written by *Arbaminus* that the *German* nation being first bred in *Germany* owed their originall to no other; Which hee labours to confirme out of *Tacitus*, *Sabellicus*, and *Seponius*. But (as *Bodin* speaks ingenuously) the ancient might well bee excused in this error: But these men are subiect to great reprehension: 1. Because they being Christians seeme to reject the authority of holy Scriptures, which testifie that all mankind was deriued from the selfe-same originall, being (as wee haue said) all confined in the *Arke of Noah*. 2. Because by this meanes, giuing to nations no other originall, then from their owne country, they distract and diuide each one from the mutuall loue and society of other Nations. For besides many other reasons which moued *Moses* to write of the *Genealogies* of people, this one seemes not the least, that men should understand themselves to bee all (as it were) kinne, and descended from the same originall; then which there is no greater means to conciliate and ioyne mens affections for mutuall amitie and conuersation. As it is reported of *Diomedes* and *Glaucus* and many others, who being armed to one anothers ruine and overthrow, haue beene drawne to breake off their hatred by the meere pretence and shew of consanguinity. But these who so arrogantly boast themselves to bee Sonnes of the Earth, not beholding to any other countrey for their offspring, strue to breake in sunder the bonds of society betwixt nations, which Gods Word and the Law of Nations binds vs to obserue. Hence grow those mortall hatreds and heart-burnings betwixt diuerse countreys, as of the *Egyptians*, against the *Hebrewes*, of the *Greekes* against the *Latines*, wherein they persecuted one the other extremely. Hence came it to passe that strangers amongst the *Romans* were called enemies, as the name of *Welch-men* with the *Ger-*

mans' signifieth as much as a *forrainger*; wherein they seeme much to degenerate from the ancient hospitality of their Ancestors, for which they haue been much praysed: Finally from this one root spring those infamous libels cast out of one Nation against another, written by such Fire-brands as delight in nothing more then dissention; but how much better were it to reconcile all people out of this assured ground of consanguinity, sith Religion perswades more to Charity and agreement, then to Faction; and contentions. But this I leane to the Diuine, whom it more properly concernes.

2. *The first inhabitants of the Earth were planted in Paradise, and thence translated to the places neere adioyning.*

For the confirmation of this point we need no farther prooffe then the authority of God himselfe, speaking in his Word, whereon all truth is grounded; But of the place of Paradise, where we place the first habitation, sundry disputes haue been amongst Diuines sufficiently examined, of late by a iudicious and worthy Writer in his History of the World. Which tract being too tedious to insert, wee will contract as farre as concernes our purpose. First therefore it would seeme meete that wee examine their opinion, which hold this History of Paradise to bee a mere Allegory: Of this opinion were *Origen*, *Philo Iudaeus*, *Fran. Gregorius* with many others: who by the four riuers of Paradise would haue to be vnderstood the foure *Cardinall Vertues*: as by the *Tree of knowledge*, *Sapience* or *Wisdom*: To which opinion also *S. Ambrose* seemes to adhere: who would haue that by Paradise should bee meant the Soule or mind, by *Adam* the vnderstanding, by *Eue* the sense, by the *Serpent* delectation, by the rest of the Trees the vertues of the mind: Against the Fathers themselves I will not inueigh, sith some men suppose their conceits to be rather allusions, then conclusions. But against the opinion it selfe, many reasons may bee drawne to proue there was a true locall Paradise Eastward: first out of the text it selfe, which saith; *For out of the ground*

*St. Walter
Ranleigh.*

ground made the Lord God to grow euery tree pleasant to the sight, and good for meate: by the processe of which Story it seemes that God first created man out of the garden, as it were in the world at large, and then put him in this garden: the end whereof is expresse to dresse and manure it: *Paradise* being a garden filled with plants and trees, pleasant to behold, and good for meate: which proueth that *Paradise* was a terrestrial garden. Secondly, to expresse it more plainly, he averreth that it was watred with a riuer springing out of a Region called *Eden*, being a country neare vnto *Canaan* in *Mesopotania* as *Ezechiel* witnesseth. Thirdly *Epiphanius* and *S^t. Hierome* vrge to this effect; if *Paradise* were such an *Allegory*, then were there no *Riuers*, no place out of which they sprung, no *Eue*, no *Adam*, and so the whole *History* should be turned into a meere fable or poetical fiction. Fourthly, it is proued by continuation of the same Story: 1 Because God gave *Adam* free-will to eate of euery tree of the garden (the foresaid tree excepted:) besides he left all the beasts of the Earth to be named by him, which cannot be meant of imaginary trees and beasts: for this were to make the whole Creation enigmatical. 2^{ly} This name is often vsed in holy Scriptures else-where as in *Ezech.* 10 *Genesis* 13. 19. which would not haue been so, if the whole story had bin meere *Allegoricall*, & *Paradise* an *Utopia*; sith the Scripture, specially the historicall part of them, are written in a plaine stile, fitting the capacity of vulgar auditors. Lastly of this *Paradise* planted in the *East*, wee may find some footsteps in prophane Poets, as in *Homer*, *Orpheus*, *Linus*, *Pindarus*, *Hesiod*, who often speake of *Aleynom* garden, and the *Elisian* fields: all which deriued their first inuention from this description of *Paradise*, recorded by *Moses* in Holy Scripture, whereof the *Heathen* themselues had some obscure traditions. The second opinion was, that *Paradise* was the whole Earth, and the Ocean the fountain of these foure riuers, which was defended heretofore by the *Manichees*, *Novatianus*, *Vadianus*, and *Gorapius Becanus*. The reasons which they alleage for their part to proue this assertion, were chiefly these. 1 Because those things which were in Scripture attri-

buted to *Paradise*, are generally ascribed to the whole world, as that place of *Genesis*; *Bring forth fruit and multiply, fill the earth, and subdue it, rule over every creature.* But this argument may easily be answered: for although the world in generall were created for man, and all men descended from the same originall, to wit, the loynes of *Adam*; yet this disproueth nothing the particular garden assigned to *Adam* to dresse, wherein he liued before his transgression: for if there had beene no other choyce, but that *Adam* had beene left to the *vniversall* (as they imagine,) why should *Moses* say, the garden was East from *Eden*: sith the world can not be East or West but in respect of particular places? Also why was the *Angell* set after *Adams* expulsion to barre his re-entrance, if it were not a particular place: for according to their opinion *Adam* should be driuen out of the whole World. Their second reason is, because it seemes impossible that *Nilus*, *Ganges*, and *Euphrates*, by so many portions of the world so farre distant, should issue out of the same fountaine. To this we answer, that by common *Interpreters* of Scripture, being ignorant of *Geographie*, *Pison* was falsely taken for *Ganges*, & *Gihon* for *Nilus*: Although it can no way be true that *Ganges* should be taken for a riuer by *Hanilah* in *India*, and *Nilus* should runne through *Ethiopia*, as we shall shew hereafter. The third opinion is, that *Paradise* is higher then the *Moone*, or higher at least then the Middle Region of the Aire: this opinion is cast vpon *Beda* and *Rubanus*; to which also *Rupertus* seemes to accord: who (as it seemes) borrowed their opinion from *Plato*, and he from *Socrates*. But these two (as it seemes) are misinterpreted, because by *Paradise* they meant Heauen it selfe as many imagine. But to confirme that this terrestriall *Paradise* is such a place, some men produce these Arguments. First that it is reported by *Solinus*; that there is a place exceeding delightful and healthsome on the top of Mount *Athos* called *Acrothones*; which being seated about clouds, or raine, on such inconueniences, the people by reason of their long liues are called *Macabrois*. Secondly they alleage for the height of this *Paradise*, that *Enoch* was there preserved from

from the violence of the flood, as *Isidore* and *Peter Lombard* maintaine: But this opinion was of the Diuines condemned in the *Florentine* counsell: and first where as they say, that such a pleasant place is in the top of the mountaine *Athos*; this neither proues that this is Paradise, neither is it so high as they would haue it: For euery high and pleasant place is not Paradise. Secondly, whereas they would haue *Enoch* and *Elias* preserved in the place, it is expressly against *Holy Scripture*, which affirms directly that the waters ouer-flowed all the mountaines, making no such distinction. Secondly should wee credit this, we might as well beleue that certaine Giants saued themselves in that high place, as some haue beleued. Besides the answer of their friuolous arguments, these reasons may bee brought against their assertion: First, that such a place cannot be commodious to liue in: for being so neare the *moon*, it had also bin too neare the *sun*. Secondly, because in this sort it had bin too neare a neighbour to the Element of *fire*. Thirdly, because (as many hold) the *Aire* in that Region by the motion of the heavens is carried about so violently, as nothing there can well consist. Fourthly, because according to *Ptolemy*, the place between the *Earth* and the *Moone* is seuentene times the *Diameter* of the *Earth*, which make by a grosse account about 120000 miles. Hence it must needs follow that Paradise being lifted vp to this great hight, must haue the compasse of the whole *Earth* for a *basis* or foundation. But this cannot be imagined: first, because it would be subiect to the eyes and knowledge of men. Secondly, it would hide the light of the *Sunne* for the first part of the day being on the East side. Thirdly it would ouer-poize the *Earth*, and so make it to shrinke out of his place; one side being farre greater and heauier then the other. The fourth conceit is of *Tertullian*, *Bonaventure*, and *Durandus*, who would haue Paradise to bee seated vnder the *Equatour*, because that contrary to the opinion of most of all the Ancients, they thought this place to be most pleasant and commodious for habitation. It is true that the places vnder the *Equinoctial* are not so burnt with the *Sunne* as some thought: but, as we haue proued out

of latter Navigators, very pleasant and fruitfull for the most part: yet cannot this be the place of Paradise; for asmuch as the Rivers of Paradise mentioned in holy Scripture, are not found to meet there: which argument might also confute them which thought it was seated vnder the *North-pole*. The last opinion which I hold the truest, is of some latter Writers, that Paradise was seated in a Region South-east from *Mesopotamia*, which is most amply and copiously proued by *Sr Walter Rawleigh*, to whom I referre my Reader: only two reasons I will allege. The first from the name of *Eden*, sith there is found an Island of this name *North-west* from the place assigned, very fruitfull & pleasant in all commodities of the Earth, and in later times knowne also by the name of *Eden*, which is likely to haue been continued from the beginning. Secondly from the Rivers of Paradise, which cannot be imagined to meet in any part of the world: for *Tigris* and *Euphrates* it is certaine that they are found in this very Region: for the other River *Gihon* that it is falsely vnderstood of a River running through *Ethiopia* is also most certaine; for such a River could neuer meet with *Euphrates*, which is out of question one of the Rivers of Paradise: for asmuch as it is so farre distant & diuided from it by the *Mediterranean Sea*: wherefore I am constrained rather to embrace their opinion which interpret *Chus* to be a part of *Arabia*, where *Chus* the father of *Noah* ferried his first habitation; which for this cause he called after his own name: but after ward in proccesse of time his posterity growing exceeding large and populous, they were enforced to passe ouer into *Africa*, and so settle themselves in *Ethiopia*, which place also they called after the same name: as wee haue seene of later yeares the *Spaniards*: at the first discovery of the *West Indies* called one place *Hispaniola*, and another *Hispania Noua* in remembrance of their former habitation. But howsoeuer it be, certain it is, that Paradise was seated in the East, from whence mankind had it's first off-spring And probable it is that *Adam* being excluded out of Paradise, was cast into some place neare adioyning thereunto, which may also from our habitable place of the West, be accounted Eastward.

3 The first plantation of Inhabitants immediately after the Deluge begunne in the East.

As *Adam* the father of all Nations before the flood began his offspring in the *East*, neere *Paradise*, so the second father of Nations *Noah* in the *East* first beganne to repeople the world, after the deluge: Which besides the clearer testimony of *holy Scripture*, may sundry waies be demonstrated: First, because it is most certaine, that the Earth beganne first to bee peopled, neere the place where the *Arke* rested, which is the mountaine *Ararat*: Whether this be a mountaine of *Armenia* as the cōmon Interpreters imagine, or the mountain *Caucasus* betwixt *Scythia* & *India*, as some later Writers with greater probabilities haue guessed, hath suffered a great dispute; all agree in this that it was *Eastward*. I will not be here ouer curious, but refer it to our historicall part, where we shall particularly handle the memorabill accidents, of particular places: Enough it is to proue that the first plantatio after the flood was *Eastward*: 2^{ly} no small probability is drawne from the *civility*, *magnificence*, and *populosity* of these *Easterne* nations before others: For it is certaine that many excellent *Arts* haue flourished amongst those *Easterne* people, before euer our *western* climate dreamed of such matters; Amongst many other matters, *Artillery* & *Printing* was in vse amongst the *Chinois* & *East-Indies* of ancient time, long before this inuention was known to vs; as the *Portugalls* who haue trauiled thither haue confirmed. To the vse of gunnes and ordinance, many suppose *Philostratus* to haue alluded, (speaking in the life of *Apollonius Tyraneus* lib: 2. cap: 14. Where he saith that the people dwelling betwixt *Hyphasis* and *Ganges* vse not to goe farre to warre, but drive away their enemies with *thunder* and *lightning* sent downe from *Iupiter*. By which meanes it is said that *Hercules* and *Bacchus* ioyning their forces were there defeated, and that *Hercules* there cast away his *golden shield*. For the other Inuention of letters howsoeuer it were by the *Gracians* ascribed to *Cadmus*, as the first Inuentour, because he was the man that first discovered it to the *Gracians*; it is most

certaine that it was as ancient as *Seth*: And that *Printing* first came to vs, from this *Easterne* part, appeares by *Iohn Guttemberg*, who brought it first out of the *Easterne* world: Which art *Conradus* being instructed in, brought the practise thereof to *Rome*, which afterward one *Gesnerus* a *French-man* much bettered and perfected: For howsoeuer amongst the *Europeans* this inuention seemed but newly borne, yet the *Chinois* had it before either the *Egyptians* or *Phanicians*: When the *Gracians* had neither knowledg nor civility: which is witnessed aboue a hundred yeares gone by the *Spaniards* and *Portugalls*. Farther for the magnificence of those nations, an argument may bee drawne from the History of *Alexander* the great, who found more stately buildings and Cities in the little kingdome of *Perus* which lay side by side against the *East-Indies*, then in all his former trauailes: for in *Alexanders* time learning & civility were not spread so farre west as *Rome*: Neither did he esteeme of *Italy* any otherwise, then of a barbarous and vnciuill place: which made him to turne his army rather against *Babilon* and the east, which seemed a farre worthier prize: Moreover, *Paulus Venetus* shewes that letters and discipline was first borrowed from the *easterne* people, without any returne of interest. A third reason may bee from the extraordinary strength of those *easterne* people in most ancient times. For it is reported by *Diodorus Siculus* out of *Clefas* that *Semiramis* the wife of *Ninus*, not many discentes from *Noah*, brought an army to innade *India*, of three millions, besides horses and waggoners: Neither had *Sannabars* her aduersary smaller multitudes to encounter her: which extraordinary strength and multitude of men could not possibly issue out of any *Colony*, sent thither from the *western* parts: And therefore it must needs follow, that they had their first offspring and originall in those *easterne* parts neere *India*. Sundrie other reasons might bee alleaged, but these I suppose will suffice to fortifie this assertion. Then it is manifest that the first *Plantation* of nations begunne in the *easterne* parts of the Earth: But where we shall place and define this *Easterne* part, seemes a matter of greater difficulty then the other.

ther. *S^r Walter Rawleigh* out of the premised arguments would seeme to proue, that this first plantation was farre east as farre as *India*, neere which, he would haue the *Arke* to rest, to wit, on the mountaine *Caucasus* lying betwixt *India* & *Scythia*: Notwithstanding the authority of the learned Author, I find that the most ancient writers haue drawne the original of all nations soone after the flood, from the *Caldeans* or at least amongst all, made them the first: For confirmation of which opinion, they vrge many strong arguments: In the first place, they vrge the testimony of *Moses* in the 11 of *Genesis*, where speaking of the first assembly of people after the flood he relates, that they came from the *East* into the plains of *Shinaar*, in which place stood *Babylon* the chiefe seat of the *Caldeans*. To this they adde the testimony of *Metasthenes*, *Herodotus*, *Ctesias*, & *Xenophon*: which haue afterwards bin seconded by *Diogenes*, *Laertius*, *Philo*, *Porphyrus* in a certaine epistle to *Boethius*, *Clemens Alexandrinus* in *Stromatis*, *Eusebius* de *Euangelica demonstratione*, *Theodoretus* lib: 1. de *Græcarum affectionum oratione*, *Rabbi Moses Maymonis filius* lib: 3. cap. 30. *Perplexorum*: with almost all the Interpreters of the *Hebrewes*: All which with vniforme consent haue affirmed that *Ciuility*, *Arts* and *sciences*, deriued their first descent from the *Caldeans*. Hence they faigne that *Prometheus* being a *Caldean*, for that he recalled men from a wilde life to a more ciuill conuersation, and taught the regular motion of the *stars* and *planets* before vnknowne, stole fire from *heaven*, and animated men formed out of clay, with a *celestiall* soule. But about all which may be collected in this kind, no small argument may bee drawne from the *marker* and *foote-steppes* of the *Hebrew* and *Chaldæy* tongues, which in no mixture of tongues, or processe of time could euer be abolished: For this, being the first of all other languages, was preserved by *Abraham* and his posterity; And challengeth antiquity before euer the *Latin* or *Græcian* tongues had any memory: in so much as all the ancient nations of the world are found in most of their originall names of Gods, peoples, Princes, and places to make vse of the *Hebrew* or *Chaldey* tongues, differing onely

in dialect, which without manifest wresting and absurdity, cannot well be deriued from other latter languages. The first father of the people of *Europe* was *Iaphet* the sonne of *Noah*, according to the ioynt consent of Hebrewes, Gracians, and Latines. To which alludes the Poet, where he saies, *Audax Iapeti genus*. This name אֲפֶת or *Iaphet* in Hebrew signifieth as much as Dilatation or enlargement: Whereas the Greeke Etymologists ridiculously draw it from many other originalls: in the like sort *Tacitus* ignorant of the Hebrew, would haue the people of *Palestine* to be called *Iudæi quasi Idæi*, from the mountaine *Ida* in *Crete*, from which he dreames they were deriued; whereas the word in the Chaldy signifies, as much as Prayers. In like manner *Ion* or (according to *Homer*) *Iaon*, supposed the first Author of the *Iones*, would the Gracians deriue from a flower, whereas the word in Hebrew signifie, as much as a deceiuer: Whence *Daniel* prophesied of *Alexander* the great, that the King of יָוֹן that is *Iaon* or *Iauan* should raigne in *Assiria*. Instances in this kind are infinite, as of *Danaus*, drawne from דָּן *Dan* which signifies a Iudge, whence comes *Dardannus* which is the seat of Iudges: Of *Ianus* from יַיִן *Iajin* signifying wine, in which sense hee is by *Halicharnisseus* called *Oenotrius*: Of *Acheis* which signifies *Greece*, *Egipt* which is streight or narrow *Nimrod* *Rebellous*. *Ninus* a sonne, *Ninive* the house of *Ninus*, *Solon quasi Solam* a peace-maker. So *Cadmus* supposed to bee the father of letters and learning, amongst the Gracians, signifies in the originall, so much as an Easterne man or an ancient man. Should wee runne any further on this point, wee should bee thought to write a dictionary, for as much as all the ancient names amongst the Gracians spring from the same fountaine: Whence that *Egyptian* Priest had good reason to object to *Solon*: That the Gracians seemed children, because they had nothing ancient amongst them: But to better purpose a Christian objected to the Gracians that *Moyse* the Lawgiuer to the Christians was ancientser then all the Gracian Gods; Other reasons are taken from the Religion of the Hebrewes, out of which seeme to be deriued all the famous religions

religions of the Earth; For to let passe the Christian, Jewish, & Mahometan Religions at this day flourishing, all of them challenging great antiquity, and taking a great mixture from the truest and ancientest Hebrew discipline: It is manifest that in the Heathenish superstitions themselves, many footsteppes haue bin discovered: which will appeare by diuers Instances. These arguments I confesse seeme very strong, but yet not of sufficient strength to enforce credulity without other warrant: To say peremptorily with Mr. Bodin, that by the consent of ancient writers, the Chaldeans are acknowledged the most ancient people, is more then I dare to venter: Neither is this opinion so strongly fortified with arguments, but Reason may steppe in to haue a doubtfull assault. Their first argument drawne from the testimony of holy Scriptures in the 11 of *Genesis*, seemes to stand on our side, altogether against them: For whereas it is said, that they came from the east into the plaine of *Shinaar*, it is manifest that the east was first peopled; or else how should this people come from the east into these plaines of *Shinaar*, to erect the tower of *Babel*? Secondly, whereas they vrge Arts, Ciuility, Magnificence of the *Chaldeans*, wee shall find it rather to agree to the people which dwell farther east, as is witnessed by the former instances. And if any object that at this day is found the contrary, for as much as we find the *Indian* to be a barbarous blind and ignorant Nation, in respect of the *Asiatickes* and *Europeans*, we answere two wayes. 1 First, that we find not by experience the *East-Indians* to bee so altogether deuoid of ciuility, but that wee may obserue not only amongst them the footsteppes, but also the practise of many ingenuous Arts, sage gouernment, policy, and magnificence, as amongst the *Chinois* and the large territory of the great *Mogull*. 2 It is not hard to imagine, that in so large a tract of time, the best settled common wealthes should be brought to nought, arts, ciuility, magnificence, be forgotten, and the rarest inuentions be cast into obliuion, especially by those two enemies of ciuility, warres and luxury; both which hauing the raignes in their own hands, are quickly able to abolish all wholesome discipline,

both.

both in Lawes and Religion. 3. Their argument drawne from the footeftepes of *Langages* in my shallow conceit, proues nothing else but that all Lawes, Arts, and Learning was deriued to the *Gracians* from the *Chaldeans*, or the Nations neare adioyning, which formerly receiued it from them. But how farre Learning might propagate it selfe the other way towards the East, is not a matter so cleare and out of question. The preservation of the Language (for ought I see) might grow from the continuance of the Religion, more firmly rooted, and for a long time continued in *Abrahams* posterity, whose abode was settled there about, whereas the other farre diuorced, as well from their first spring, as the monumentall seales of their religion, quickly turned Religion into Pagan Idolatry. Many reasons besides the disproouing of this former opinion may bee alleged to proue the *Easterne* part of the world to haue bin first peopled: amongst which I will only cull out this one, grounded on the text of holy *Scripture*. It is warranted out of the text: 1. That when the waters began to decrease vpon the face of the earth, and the *Arke* began to rest vpon the mountaine *Ararat*, *Noah* sent out a dove to make triall, who returned with an olive branch in her mouth. 2. That neare the place he issued out of the *Arke* with all his family, he planted a vineyard, and was drunke with the iuyce of the *Grape*, not knowing the strength thereof: out of which by all probable coniecture must needes bee collected, that the Regions neare the place where the *Arke* first rested, by the benefit of Nature afforded both *Vines* and *Olines*: for we cannot imagine the silly *Dove* at the time of the flood empty gorged to haue flowne very farre ouer the face of the waters to obtaine this *Oliue* branch, nor *Noah* after the flood to haue gone very farre to seeke out a conuenient place for his Vineyard: whence it is most likely that the *Arke* rested in such a place, whose neare adjoining Regions are enriched with such commodities. But this cannot bee verified of *Armenia*, wherein for ought my reading informes me, are found neither *Vines* nor *Oliues*, whereas some places Eastward, whereon the *Arke* according to this other opinion was supposed to rest,

rest, afford both in great plenty. To vmpire betwixt these two opinions, I leaue to my friendly Readers; because it is not in our power to command, but obey Reason.

CHAP. XIV.



Of the original of Inhabitants of the Earth we haue spoken: It remaines wee now treat of their naturall Disposition.

There is nothing more subiect to admiration, then the diuersity of naturall Dispositions in Nations; a matter eident to the eye of obseruation, and needing no proote or demonstration: for who obserues not in all Nations certaine naturall or nationall vertues or vices, which neither time nor Lawes could euer change or correct. For not to rue farther off then our neighbouring Nations Confinnes; what Writer in this kind almost, were he not very partiaill, hath not taxed pride and ambition in the *Spaniard*; leuety, or rather (as *Bodin* would haue it) temerity in the *French*; dangerous dissimulation in the *Italian*; Drunkennesse in the *Dutch*; Falshood in the *Irish*; and glotony in the *English*. And how soeuer many meanes haue bin put in practise, either by the seuerity of lawes to curb such enormities, or the subtilty of discourse to shroud these vices vnder the name of vertues: yet these marks are found to stick as close as the spots vnto the Leopard, as neither altering their pristine hue, or yeelding to time or statutes: And if it happened at any time that by extraordinary violence some litle alteration were wrought, yet some few yeares would find it returne againe vnto his owne nature and disposition. This variety of dispositions being very many, and depending on sundry causes, to helpe memory, we will reduce into certaine heads, out of which in the generall we may giue a iudge.

a iudgement, leauing the rest to our speciall Tract. The name of naturall disposition in this place we take in the largest sense, so farre forth as it comprehends vnder it the Complexion, Manners, Actions, Languages, Lawes, Religion, and Government. All which so farre forth as they depend from the places we will shew. Neither intend we to handle nicely all these specialities, forasmuch as the Manners, Customes, Lawes, (and for a great part) the externall rites of Religion depend on the naturall constitution of the Inhabitants: so that little can bee spoken of the naturall constitution, but of such actions, effects and markes as shew themselues in their ordinary customes & manners. Wherefore we shall be constrained to treat of them together, the one being a great furtherance to the explanation of the other.

- 2 The naturall disposition of the Inhabitants of the Earth may suffer change and diuersity, either in respect of the site, or in respect of the quality of the soile, or in regard of the Inhabitants themselues.
- 3 The site is the respect which one place in position beareth to another: Here a Nation is diuided into, 1 The *Northerne* or *Southerne*, 2 The *Easterne* or *Westerne*.
- 4 The *Northerne* is placed in the North Hemisphære, berwixt the *Aquatour* and the *Artick Pole*; The *Southerne* on the opposite side berwixt the *Aquatour* and the *Antarticke Pole*.

Of the *Northerne* and *Southerne* Inhabitants wee speake not here respectiue, as in regard of the same Hemisphære, but absolutely in regard of the two Hemisphæres and their

Inha-

Inhabitants. How these 2 Hemispheres of North and South are varied in respect of the quantity and disposition of the soile is deciphered before. What diuersity that be found in the people or inhabitants shall be shewed in this Theoreme.

The people of the Northerne Hemisphere aswell in riches and magnificence, as valour, science, and ciuill gouernment, farre surpasse the people of the South Hemisphere.

The people of the Northerne Hemisphere wee vnderstand to bee the *Europeans*, the *Asiatickes*, the hithermost *Africans* being the greater part the Inhabitants of *America Mexicana*, with the hithermost part of *America Peruana* together with the people inhabiting the vknowne land, lying vnder the Artick pole, with all the Islands belonging to each of these. The people of the Southerne Hemisphere containe a moiety Southward of the *Africans*, the Inhabitants of *America Peruana* for the most part; the people of the *Terra Australis incognita* or the south Indies, with some Islands belonging thereto. Betwixt these two partitions, If we make a comparison we shall find a greater disparity, then euer any inuention of man could any wayes reduce to any shadow of Equality, or any Trauailers obseruation could euer steppe in to diminish. To begin with the riches, It is certaine, that the increase of it in any nation proceeds, either from the benefit of the soile or from the skill and diligence of the inhabitants. The benefit of the soile either in respect of the quantity of the ground, or the quality of the soile in this southerne part, we haue at large proued to be farre inferior to that of the Northerne Hemisphere. The diligence of the people we can measure no other wise then by their Traffick with forraigne nations, or their good husbandry of their owne commodities. Their traffick with forraigne nations, is suspected to be little or nothing at all, in respect of the northerne inhabitants having small commerce or knowledge of forraigne nations, and that rather enforced by violence and conquests; then any way desired of

them

them; Whereas scarce can be found any nation of the Earth, which cannot by commerce or traffick with forraigne Countries, at least neighbouring confines both strengthen theſelues, and draw riches from other nations: Leſſe can be hoped from their homebred induſtrie, which is content with ſufficiency, neuer aiming at farther riches then naturall neceſſity ſeemes to exact, as may appeare by all records and Hiſtories almoſt which haue treated of this matter. If we conſider the ſtate & magnificence of either, wee ſhall acknowledge a great difference, as diſdaining all compariſon. The firſt offspring of all nations owes it ſelfe (as we haue proued) to our Northerne hemiſphere, which that Almighty Creatour of al things bleſſed with knowledge and ciuill gouernment, before euer this Southerne coaſt was knowne or mentioned. All the acts of the *old and new* Teſtament performed on this ſide of the Equator, can ſpeake the ſtate and magnificence of theſe nations, leaving the other as yet neglected without memory or Hiſtory. Neither hath the Chriſtian religion, the true ground of all ſettled gouernment euer bin ſo propitious, as to ſmile on theſe miſerable Nations, as yet groaning vnder the ſeruile bonds of groſſe ignorance and Pagan ſuperſtition. Where ſhall we find in any records or antiquities, any ſtate amongſt them to parallell the foure greater Monarchies of the *Aſſyrians, Medes, and Perſians, Grecians, and Romans*, or the later riſen out of their aſhes, whercof this one age can produce no few examples? What place is extant at this day in *Europe, Aſia*, the Northern tract of *Africk* or *America* (ſome few Deſerts only excepted) which haue not been either by knowledge receiued from forraigne Nations, or ſome other meanes in ſome ſort reduced to ciuility? At leaſt to haue embraced ſome ſettled forme of gouernment: Whereas the Regions daily diſcouered in the Southerne moiety are found moſt barbarous, without lawes, ſciences, or ciuility. Or if any ſuch perfection ſhew it ſelfe amongſt them, it is manifeſt that it is owed altogether, to the induſtrie of the Europeans, who with great coſt and trauaile, haue brought them ſuch riches whereof the poore wretches neuer knew the want. Inſtead of

so many Colonies sent out of Europe & Asia into these Southerne Regions, no record I suppose can mention one euer sent from them vnto vs. Which is an argument of their ignorance and want of traffick. What shall I speake of the swallour and prowess of the Northerne inhabitants, hauing by the sword erected so many kingdomes, and (as it were) without resistance brought into captivity those Nations of the South? of Arts and Sciences what can be said; but that the Northerne Inhabitant hath all, and the other in a manner none: For liberal and ingenious sciences and Schooles and Vniuersities dispersed in most parts of *Europe* and else-where can speake our glory: Which for ought I could euer learne the Southerne Continent, neuer saw; and admit they know some thing in some Mechanicall arts, it is no more then necessity requires. Neither in the number and extent of inuention, or curiosinesse of workmanship answerable to that wee find at home. The artes of Printing & Artillery were I suppose neuer of their acquaintance, except perhaps the later, which I dare sweare hath had better acquaintance then welcome; as that which neuer shewed it selfe but to their ruine: No obiection can here take place in this comparison, except some man suppose the monuments and Trophies of these nations, either being very ancient haue miscarried by time, or else being of a newer birth are hid, wanting the light of discouery. But this is a mere coniecture wanting ground: For what Antiquity or record could euer shew so much, as the footsteps or markes of any such monuments? as for the countries as yet vndiscovered, no better coniecturall iudgement can be giuen, then by that which is already found: For where all other reason and obseruation is silent, I alwaies hold equality the best measure: Another argument not inferiour to the rest, is the antiquity of the Northerne nations; which without all question is farre greater then that of the Southerne: Because we cannot imagine any man so aduenturous to passe into these remote quarters, till such times as the places neerer adioyning, growing too populous; constrained them to seeke out a new habitation; which no man could conceiue to be but in many yeares after.

after the vniuersall Deluge.

- 5 Each Hemisphære with the Inhabitants therein contained, may againe be diuided according to the *longitude* or *latitude*: according to the *Latitude*, Inhabitants may be called either the extreame or Middle.
- 6 The extreame inhabitants are either the *Northerne* or *Southerne*. The former in the higher Hemisphære. The other are the inhabitants thereunto opposite in the other Hemisphære.
- 7 The middle Inhabitants are such as are situate in the middle betwixt the *Aequator* and the Pole in either Hemisphære.

The mistaking of the true limits of North and South in this our *Northerne* Hemisphære, hath caused great error amongst the Ancients: Inasmuch as *Hippocrates* pronounced the people of the North to be of a leane & dry disposition, of a small and dwarfish stature; whereas other writers out of a good obseruation have found them to be of a tall stature, big-boned, & of a most able constitution in respect of those of the South. To compose which difference we must haue recourse to that sub-partition of the Hemisphære before mentioned, wherein we allotted of the 90 degrees accompted from the *Aequator* to the Pole, 30 for heat, 30 for cold, & 30 for temperament; Whereof the former lyeth Southward to the *Aequator*; The second is accompted from the pole: the other is conceiued to lye betwixt both. But because wee find this Mathematicall diuision to be too precise, to answer the obseruation of Writers in this kinde, we must a little alter these bounds, that these rules may rather stoop to *Nature* and obseruation.

then

then Nature bee squared to our owne conceits; yet shall wee shew in a generality, and for the most part, that the naturall disposition of the Inhabitants, ought to be iudged and measured according to these limits: though not exactly answering in precise degrees. Wherefore towards the North wee limit these (with *Bodin* & other good writers) which lie from the 50th degree Northward to the 70th, in which Tract we shall find our *Brittaines*, *Ireland*, *Denmarke*, *Gotland*, the lower *Germany* from *Moenus* and *Hipanus* to *Scythia* and *Tartary*, which take up a great part of *Europe* & *Asia*: on the South we place the most Southerly *Spaniards*, the *Sicilians*, *Peloponnesians*, *Cretians*, *Syrians*, *Arabians*, *Persians*, *Susians*, *Gedrosians*, *Indians*, *Egyptians*, *Cyranians*, *Carthaginians*, *Nuamidians*, *Lybi-ans*, *Moors*, and the Inhabitants of *Florida* in *America*. The middle Region is meant that which lyes iust in the middle place betwixt the Tropicke and the Pole; not that which lyes betwixt the Pole and the Line: the reason whereof wee haue shewed before; because the places vnder the Tropicks are found to bee hottest, but vnder the Line more temperate; so that our temperate Climate here we place that which beginnes at the 40, and endeth at the 50 degree of latitude: In which Climat be the Northernmost *Spaine*, *France*, *Italy*, the higher *Germany* (as farre as the *Mase*) both *Hungaries*, *Myria*, both *Myhia*, *Dacia*, *Moldania*, *Macedon*, *Thrace*, and the better part of the lesser *Armenia*, *Parthia*, *Sogdiana*, and a great part of the greater *Asia*: so that all the Nations as yet mentioned in histories, and perfectly discovered in our Northerne Hemisphere are contained betwixt the 50 degrees of latitude and the 60. What to thinke of the Nations dwelling betwixt the two Tropicks, and those which are 60 degrees to the Pole, for want of accurate obseruation and History we can set downe no certainty: yet so farre as men may iudge by conjecture, we may accompt in the Region betwixt the Tropicks, the 15 degrees from the Tropicke towards the Line, to be of like quality with the 15 degrees without the Tropicke. The Tract in the middle vnder the Equatour, being more temperate, then that of the Tropicks, may be iudged to come neere

the temper of the middle Region betwixt the Tropicke and the Line, though perhaps somewhat hotter. For the Regions very neere the Poles, lesse certainty can be collected; yet that little which we find concerning the nature of these Inhabitants we will not omit. According to this partition of our Northern Hemisphere, we may make iudgment of the other; because where no other cause shewes it selfe, we may well guesse these places which are of equall site to be of equall disposition, so far forth as they respect the heavenly operation. All which concerne the naturall disposition of the Inhabitants, wee will reduce to these three heads; to wit either 1 the bodily qualitics; 2 the mentall Affections, 3 the outward Actions.

I. The Extreame Inhabitants towards either Pole, are in complexion Hot and Moist: Those toward the Equatour Cold and Dry: those of the middle indifferent as partaking of both.

The confirmation of this proposition depends on 2 points: the first is the Declaration of the Cause of this diuersity: the second is the effects and diuers tokens which this variety of temper produces, as well in the Accidents of the Body as the Mind. The cause we haue partly before opened; which is the Heat of the Sunne in Climates neerer the Equatour, and the Cold in places farther remote, and situate neerer the Pole: whereas the former, working on the Internall heat and moisture of men and all other living creatures living in those hot Climates, drawes in, and consumes it in such sort, that little remaines but Cold and Dry Melancholy, as the Seas in the bottom, the other parts being (as it were) euaporated. For by how much more heat any man receiues outwardly from the heat of the Sunne, so much more wants he the same inwardly, which euery man may see confirmed out of ordinary experience; since that our naturall heat is far more vigorous in Winter then in Summer, and that our joints are more operative in frosty weather, and then when the Northwinde is blowing. On

the

the other side in the Summer wee commonly obserue the contrary: we find our ioints lazy and heavy, our Appetites dull, as may also bee perceiued in the *English, Germans, and French*, trauieling from the *North* Southerly into *Italy* and *Spaine*, who if they confine not their dyet to a sparing rate, they commonly are surprized by surfets: an example we haue of *Philip Duke of Austria*, liuing in *Spaine* after his *German* fashions. But on the contrary if a *Spaniard*, who in his owne Country is inured to great Niggardliness, arrive in our *Northerne* Countrey, he commonly proues a better trencher-man then our native Inhabitants. And this *Bodin* obserues to fall out true, not onely in Men, but also in beasts, which driuen towards the *North* waxe fat, and prone well; but towards the *South* they pine away and waxe lean: which may well be confirmed out of *Leo Afer*, who auerres, that almost throughout all *Africke* you shall find few or no herds of cattle or horse, few sheepe, and scarce any milke: whereas each mans Table almost in *Germany* and *Britanny* can giue a plaine demonstration of our Countreys store in this kind: Hence may appeare that as the heat of the Sunne towards the *Equator*, by drawing out the internal heat and moisture causeth men inwardly to bee left cold and dry; so towards the Pole the internal moisture being preserued from the Excesse of Externall heate, and the internal heat being strengthened and thickned by externall cold, haue left vnto them a complexion of heat and moisture. The middle Region betwixt both extreames being compounded of both, must needs by mixture and participation inioy a middle quality. Besides this exposition of the causes of this temper wee shall obserue many speciall markes and Instances which will discouer this variety of disposition. First, it is plaine that heat and moisture are the two qualities of fecundity: Whence it must consequently follow, those Regions which are most populous to bee chiefly endowed with this quality and disposition. Now where shall wee of this Hemisphere find any Countrey to whom Nature owes a greater increase of mankind; but in the *North* amongst the *Goths*, the *Sythyans*, the *Scandians*, and *Germans*, by whose abun-

dant fertility, vast deserts have beene cultured and inhabited, stately Cities have bin founded, Colonies have bin transported and deriued almost into all Europe. Hence haue *Methodius* & *P. Diaconus* compared the armies of the North to swarmes of Bees; and the North is termed by *Olau Magnus*, the storehouse of mankind: to wit, from which so many strong Nations, as the *Goths*, the *Gepids*, the *Hunnes*, the *Cymbrians*, the *Lombards*, the *Alans*, the *Burgundians*, the *Normans*, the *Poles*, the *Heruli*, the *Sacnians*, the *Slans*, the *Switzers* and the *Russians* are not ashamed to deriue their Ancestry. But here may bee objected that the *Southerne* people are much more addicted to *Venerie*, then the *Northerne*, which seemes an argument of greater Heat: But to this I answer, that this insatiate appetite of *Venerie* in the *Southerne* people, proceeds not from heat, but from *Choler Adust*, and *Melancholy*: which humours carry in them a Salt and sharpe quality (according to Physicians) which stirres vp their appetite to *Venerie*: which we may plainly obserue by experience: for no men are more moued by this itching appetite of carnall Copulation, then *Melancholy* men. But how soeuer this affection is most predominant in such men, yet it is hardly seconded by performance; which makes Geographers to ascribe more promptnesse of generation to the *Northerne* men; although sensuall concupiscentie raigne more in the *Southerne* men; which indifferent proportion was without doubt granted to either, by the prouidence of Almighty God, that they who were endowed with a greater sufficiency, should lesse affect sensuall delights then the rest, which want that proportion of heat and moisture. And those of the other sort should haue their Appetites more raised vp to wantonnesse, without the which their off-spring would soone fayle. A second argument to proue our assertion is the Tall and large stature of the *Northerne* man, which argues both heat and moisture; whereas the *Southerne* man is small and dwarfish in stature; composed of weak and feeble Nerves. That the people situate towards the Pole in a moderate distance, surpass in greatnesse, can be shewne not only in this our Hemisphere in the *Germanes*, *Scythians*, *Belgians*,
and

and others; but also in the other by the *Pantagines*, whose situation Southward answers somewhat neere to the height of *Germany*. That moisture is a great cause of growth, appears as well by Trees and other vegetalls, which growing in low and marish grounds increase to a most incredible greatnesse; as of those forementioned on the side of *Rio Negro* in *Peru*, and neere the Lake *Hiarotis* in *India* as by Beasts. For first we find the moistest to bee of greatest stature, which is the reason why the great Whales and fishes in the sea grow to such a vast quantity. Secondly, such Beasts as haue hot and moist bodies cannot so well prosper and liue in those Southerne countreyes; as the horse which by nature being hot and moist, liueth but faintly in *Ethiopia*, yet is of good strength in *Scythia*; Whereas the Ass being by nature hot and dry is of great account and seruice in *Africke*, in *Europe* little respected, in *Scythia* cannot liue. Neither is moisture sufficient for the growth except it bee stirred vp by heat: wherefore we may conclude hence that the Northerne man hath both: Out of the contrary effects, wee may likewise collect, that the Southerne man wants this quality. These reasons indifferently proue these qualitics to wit, of heat and moisture, to bee in the Northerne man, and the contrary in the Southerne. Diuerse other arguments are vied, some to proue the one quality, some the other apart. A great argument of heat in the Northerne man may bee his extraordinary drinking: A vice which could neuer bee reformed or corrected by times or statutes. This drowth of theirs stirring vp this desire of drinking, can proceed from no other cause then their heat: Whereas the Southerne man is seldome taxed of this vice: not because hee is more religiously temperat then the Northerne; but rather for the naturall temper of his body, which can neither require or beare so much as the Northerne. In so much as *Bodin* seemes to make a doubt, whether the immoderat drinking of the *German* is to bee esteemed a greater fault, then the niggardly sparing humour of the *Italian*: sith both arise rather out of nature then education: Another argument of heat in the Northerne man, is the extraordinary strength

in respect of the Southerne man; which is an apparant demonstration of heat. Wee find that the bloud of the *Scythian* is full of small strings such as are in the gore of Bulls and Bores, and betokeneth strength: Whereas the bloud of the *African* is thinner, such as is in a Hart or Hare. No lesse are those reasons which especially proue the Northerne man to bee endowed with much moisture. Thirdly wee may much better argue from the Physiognomicall accident of the body: wee shall find the inhabitants vnder the *Tropickes* to bee exceeding blacke: vnder the *Pole* it selfe beyond 60 degrees somewhat browne, but from thence about 60 their colour is reddish: from thence to 45 degrees whitish: about the 30 they beginne to wax yellow; and then somewhat enclining to Greene: all which proceeds out of the variety of heat and cold: For the Blacknesse of the *Africans* about the *Tropickes*, wee can ascribe to no other certaine cause; then externall heat, and internall cold, his necessary concomitant: neere to which approacheth the yellow and Greene colour of the people not farre of; Whereof the former discouers *Choller* and *Adustion*: the other *melancholy*. And howsoeuer the brownnesse of the people dwelling very neere the *Pole* may come by reason of externall cold, which by excoffe, rather dries vp their moisture, then strengthens the internall heat: Yet the Red colour of the Inhabitants about 60 degrees is a firme argument of heat: and the white hue of the middle people, an apparant marke of a middle temper. No lesse may bee collected from the eyes and haire of these three Nations. The eyes of the *Scythians* are generally tending to a gray colour; The remote haue them of a blew-whitish shining colour; as the *Cymbrians* and *Danes* according to *Plutarch*; The *Britannes*, *Germanes*, and *Normans* come neere vnto this colour, but haue them not altogether to gray and shining but more obscure. But the Southerne man hath the colour of his eyes much enclining to blacke. Now if wee will beleaue *Aristotle* in his Problemes, the gray colour of the eyes is a very great argument of heat; But the blackish colour argues the want of heat; Those which dwell in the middle Regions, haue for the most part their eyes of a darke-blew, which colour

colour is apparent in the eyes of Goats, which as *Pliny* writes are neuer pur-blind or dimme of sight. Many speciall arguments besides those before mentioned, are produced to shew the *Northerne* man to surpass in moisture, as the other in drouth: The first may be taken from their voice, which in the *Scythian*, or *Northerne* man is tending to hoarsenes; but in the *Africans* very sharp and shrill, as in the *Ethiopians*, & *Carthaginians*, and the most southerly *Spaniards*. That this difference doth arise from the moisture of the one, and the want of it in the other may as easily be perswaded, because we obserue women which are moister then men, to haue sharp & shriller voices: Also that too much moisture in wood or mettall makes the sound of it very hoarse and harsh; as wee see in lead, whereas other mettalls giue a shriller sound: Another reason is drawne from their extraordinary sweating; for it is obserued, that *Northerne* men traouailing towards the *South*, or warring in hotter Countreyes, are like to faint and perish through extraordinary sweating, as *Plutarch* in the life of *Marius*, records of the moist bodies of the *Cimbrians*. Thirdly, it might seeme wonderfull which *Tacitus* relates of the *German* nation, that they loue sloth and yet hate rest; because (as in *Children*) the naturall heat prouokes them to Action; but the moisture procures Softnesse: whence they must either fight or sleepe. Hence the *Italians* and *Spaniards* make accompt, if they can suffer or withstand the first or second assault of the *French* or *Germans*, easily to vanquish them; because as *Marius* and *Cesar* obserued of the *French*, that in the first assault they shewed themselves more then Men, in the second lesse then Women. A fourth reason not inferiour to the rest may be drawne from the soft bodies, of the *Germans* and *Scythians*, not any way patient of labour, hunger, and thirst; although very strong and able to giue a suddaine encounter or venture on a warlike exploit: The contrary in all shall we find in the *Southerne* man; out of which we may well collect, that he enioies a contrary temper: Besides all which we haue said concerning this assertion more shall appeare hereafter by these subsequent Theoremes.

2 The extreame Inhabitants towards the Poles are more naturally inclined to Mechanicall workes and Martiall endeauours: the Extreame towards the Equatour to workes of Religion and Contemplation: the middle to lawes and ciuility.

There are found three kinds of discipline, which vsually inuade and occupy the mind and faculties of man: The first are Mechanicall and externall operations, the which are projected in the Intellectual part, yet receiue their perfection from the hands and externall organs: Such as are *Artillery*, making of *Ordinance*; casting of mettalls, and *Chymicall inuention*; *Printing* and the like Arts. The second is *Contemplation*; separate & removed from externall operation. The third as the meane betwixt both, is Ciuill and Morall discipline, whose act and perfection consists, in the making of *Lawes*, establishing and gouerning of States, prescribing and maintaining of Diuine worship, with other matters of the like nature. These gifts it pleased God so to distribute to mankinde, that the former should bee most appropriate to the *Northerne* man; the second to the *Southerne*, the third to the inhabitants of the middle region: in such wise as the one should need, and not enuy the others perfection. All which we shall demonstrate first out of the causes and ground; Secondly, out of the effects. The causes wee haue shewed in the former Theorame, wherein wee haue ascribed to the *Northerne* man abundance of heat and moisture in respect of the other; which are the chiefe aides of the imagination, on which mechanicall faculties depend; also their plenty of bloud and humours distempering their minds: they are, by this meane lesse giuen to contemplation. The *Southerne* men hauing cold and dry braines, are of greatest vnderstanding in *Contemplatiue* matters, being (as it were) by reason of *melancholy* abstract from externall operation. The middle temper of the braine and humours must needs

be

be the mother of a middle discipline, which is found to be that which concernes *Manners*, *Laws*, and *Religion*. Here some haue gone about to reduce these three kinds of people to three planets answerable to these 3 dispositions.ouer the Southerne people they set *Saturne*: the Northerne they commit to the gouernment of *Mars*; the middle inhabitants to *Iupiter*. The power of *Saturne* according to the *Chaldeans* consists in *Contemplation*; of *Iupiter* in *practicall action*; of *Mars* in *Artifici- all operation*. Which 3 properties may be well gathered out of the *Hebren* tongue, natures best interpreter; for *Saturne* they call שוהמא which is as much to say as quiet; because nothing better befits the nature of contemplation then retired quiet- nesse: *Iupiter* they call צדק which is as much to say as *Iust*: Which the *Grecians* hauing receiued from these *Hebrenes*, they fained *Iupiter* to bee the God of *Iustice*. *Mars* they cal- led מאדים which signifieth strong or puissant, for which cause the *Chaldeans* and the *Grecians* would haue *Mars* the God of warre. To *Saturne* they ascribe cold, to *Mars* heat, to *Iupiter* a temperature betwixt both. To the first, they impute the inuention of sciences and such as concernes *Con- templation*; To the second *practicall prudence*; To the third *Arts and Workmanship*. Whereof the first depends from the *Vnderstanding*, the second from *practicall discourse*, the last from the operation of the *phantasie*. But to come neerer the matter and descend to particulars: wee will first beginne with the *Northerne* man whom we shall find to be the father of most *mechanicall Inuentions* as of *Gunnies*, *Printing*, the art of *Liquefaction*, *Chimistrick* with infinite other excellent *Arts*. Hence it comes to passe that the *Italians* and *Spaniards*, are vsed to send ouer for *Britains* and *Germans*; as for those which are endowed with a heauy gift in the Inuention of *veines of Mettals* vnder the Earth, as also for the opening and well ordering of such *Mines*: Let any man cast his eyes on *England*, the *Nether-lands*, *Germany*, he shall find the *Inha- bitants* generally, either as the *Schollers* and darlings of *Mars* wielding their *Swords*, or as *Pioners* trenching of *mountaines*, or as *Enginers* contriuing the course of *waters*, or hunting in the

the woods, or plowing in the field, or looking to their flocks on the mountaines, or working in their shops, or at least set vpon some externall worke or other: that their wits. (as *Bodin* merily speakes) might seeme to bee in their handes. From whence come for the most part our seuerall sortes of stufes, our choise workes in wood, mettall, Iuory, our variety of instruments, from the *Italian* or *Spaniard*? No truly: they can rather admire then imitate; and better set vs the materials then inuent the workmanship, like those distressed *Israelites* which were enforced to runne vnto the *Philistines* to haue their swords sharpened. As we ascribe to those nations of the North this perfection in operative and externall faculties: So cannot wee deny the Southerne man his due prerogative, which is Religion & Contemplation. For these nations being aboue all other affected with melancholy, willingly withdraw themselves from common society into Desarts, and remote receptacles, more accommodated to abstracted meditation: For contemplation (being of the *Hebrewes* tearmed a precious death) hath a speciall force to sharpen the wits of men, and by separation, (as it were) from the dregges of the vulgar, not onely opens vnto him the secrets of nature, but giues him wings to flie vp to heauen in sacred meditation. Whence it cannot seeme strange that from these parts at first proceeded the *Prophets*, *Philosophers*, *Mathematicians* of great estimation. Also that almost all Religions of any great moment, owe their first originall to those parts: we need roue no farther then the *Hebrewes*, *Chaldeans*, *Egyptians*, *Gracians*, whom wee shall find the first foundets of Diuine and Humane Sciences. Which historicall obseruation dissents not any whit from the iudgement of the Naturalists: Because (as *Huarts* obserues) the true foment of the best ynderstanding, consists in the cold and drye braine incident to melancholy. And *Aristotle* obserues, that beastes themselves are so much the more aduaged to approach the prudencie of man, by how much they partake the quality of cold. An instance of which may bee giuen in the *Elephant*, whose blood (according to *Pliny's* Testimony) is coldest of all other Creatures. To this I might adde for an argument.

gained it of the religious disposition of the *Southerne* man, what *Ald. Afen* writes concerning the vast number of Temples in some places of *Africke*, as about *Fesse & Morocco*; their strict observation of holy rites; their rigide Ecclesiasticall censure, with much like. What is spoken by *Aluarez* of the hill *Adama* in the midst of *Africke*, of their strange Library, Churches, Pallaces, with other matters of this purpose, would serve well to my purpose; had I the ingenuity to beleene the Iesuite. But against this may be objected perchance that the Christian Religion which is the truest and only Religion hath no great footing as yet amongst those *Southerne* Nations. Secondly, that their Churches have no perfect platforme of Ecclesiasticall government, as we find in other Churches towards the *Northerne* tract. To the first I answer; that we here speake of the Inclination of men to Religious exercises, so far forth as it depends on their naturall disposition; not respecting this or that Religion: for to bee informed in the true Religion and reiect all other, depends not any way on the naturall Inclination of men, but on the immediate gift of the Almighty God; which is pleased oftentimes to make election of one Nation before the other, to make the one (according to the *Apostle*) a vessel of honour, the other of dishonour. To the second I likewise answer, that in Religion two things are to be considered: First the Religious and devout Inclination of man to embrace diuine contemplation: Secondly, the well ordering and governing of Religious actions; according to Lawes and Statutes pertaining to the externall regiment of the Church. The former only being granted to the *Southerne* man, wee may ascribe the perfection of the other to the people of the middle Region; whom we haue pronounced to bee most happy in the managing of Ciuill affaires and Politicke government. Now to proue this people to bee best endow'd with this faculty, many reasons may bee alleaged; because according to the testimony of most approued writers, wee haue found Lawes, Manners, Statutes, &c. the best manner of governing Common-wealths to haue proceeded from these Nations. For Histories will shew vs, that the greatest and best empires

of

of the world haue flourished in *Asia, Greece, Assyria, Italy, France, Germany*, which lie betwixt the *Equatour* & the *Pole*, from the 40 to the 50 degrees: And that out of these haue alway proceeded the best commanders, the most prudent States-Men and Law-giuers, the wisest Lawyers, the most eloquent Oratours, the wariest Merchants. Whereas neither *Africa* in the *South* nor *Scythia* in the *North*, could euer boast of many Law-giuers or States-Men worthy note; whence *Galen* complains that *Scythia* neuer brought forth any *Philosopher* besides *Anacharsis* of any great credit.

- 3 *The People of the Extreame Region towards the Poles in Martiall promesse haue commonly proued stronger then those neere the Equatour: but the middle people more prouident then either in the establishment and preservation of Commonwealths.*

The grounds of this Proposition wee haue layd before: for the former clause, that the people of the North should proue more puissant then these of the South, may well bee concluded out of their naturall strength of body, and their courage of the minde: whereof the latter makes them ready to attempt, the other to execute most chiuallrous designses. Neither want there most true and pregnant examples in history to second this principle: for euery man that is indifferently seene in history may obserue with wonder how the strong Nations of the *Scythians* haue invaded the *South*, winning from them many *Trophies* and victories: whereas wee seldome find any expedition set on from the South to the North (except to the losse or ruine of the South) worth any memorable relation. To this many would haue these threatening prophecies of *Jeremy, Ezechiel, and Esay* to allude, which foretold, that *from the North should issue warres, troopes of horsemen, and the Ruines of Kingdomes*: This we shall obserue to bee true not only in the generall, but almost

most in all particular States, which wee shall find propagated from the North to the South. The *Assyrians* at first ouercame the *Chaldeans*; the *Medes* the *Assyrians*; the *Persians* the *Medes*; the *Greekes* the *Persians*, the *Parthians* the *Greekes*; the *Romans* the *Carthaginians*, the *Gothes* the *Romans*, the *Turkes* the *Arabians*, the *Tartars* the *Turkes*: and how focuier the *Romans* by their prowesse wanne somewhat towards the North, yet found they by experience that beyond *Danubius* no great matter was to be expected; for as much as these Nations could not be easily vanquished, and being overcome would not away with subiection: which (as some say) was the cause that *Tralan* having built a great Bridge of stone over the *Danow*, was perswaded to breake it downe. *Tacitus* expressly confesseth, that the *Germans* were too hard for the *Romans*, and could not haue beene overcome by them, but by the advantage of the weapons and manner of fight; wherein the *Romans* having long continued a civill Nation, had practised themselves: which he secondeth by many instances, drawne from severall conflicts betwixt the *Germans* and the *Romans*, which he might well speake; for as much as himselfe reports 110 yeeres were spent in the conquest of *Germany*, and no Nation so much troubled them as this; which notwithstanding when all was past, was thought to bee triumphed ouer rather then conquered. It were an infinite taske to write all which *Tacitus* relates of the valour and warlike disposition of the *Germans*, being a Nation louing rest, and hating *Idleness*, punishing cowardice with Death, and reputing it an inexplable shame for a subject to see his Prince slaine in Battaille, and returne aliue without him. As much or more hee reports from *Julius Agricola*, then *Proconsul* of *Britany*, of our ancient *British* Nation whose factions and dissensions amongst themselves gaue occasion to the *Roman* victory, and not the *Roman* valour wherein hee confessed them no way to stand inferiour. To strengthen this assertion, History will afford an euidence almost in euery corner of the world, wherein wee shall find the North by sundry conquests to haue preuailed against the South. In the East parts wee find that *Cingis Can* a Northerne

therne *Tartar* conquered the *Indians*: That the *Tartarians* also conquered the *Armenians*; and yet the *Armenians* had such advantage against the Southerne people, that the *Mamulukes* esteemed a strong Nation in *Egypt*, were first chosen out of *Armenia*. Also wee find that the people of *Cashay* subdued the *Chinois* and the *Indians*. Wee read also that *Mahomet* a *Saracen* Sultan of *Persia*, hired certaine Northerne *Scythians*, with whose strength hee ouerthrew the Caliph of *Babylon*, who dwelt afterwards in *Turcomania*. Neither wants *America* many examples in this kind, and no question but many others haue been drowned in obliuion for want of History. We find that the people of the North in this Continent preuailed against the South, and conquered *Mexico*, which was afterwards subdued againe by *Cortese*; and by later discouery of our *English* nation we are giuen to vnderstand that the people about *Terra de Laboradore* are a fierce warlike people, in so much as rather then they would yeeld themselues to be taken captiue by our men, they haue been scene to make away themselves. To goe no further then our own countrey, who knowes not how many famous ouerthrowes haue in later Ages beene giuen to the *Spaniards* and the *French*; especially to the later, who haue feared the vter vndoing of their State: yet neither of these two great Kingdomes could euer attempt any thing against the *English*, worthy Chronicle or obseruation. If any man object the actions of King *William* the Conquerour, wee can answer many wayes: first that hee wanne the soueraignty not meere by the sword, but by Agreement and composition, challenging a promise from King *Edward* the predecesour, and being fortified with a strong faction of the nobility of the Realme: and moreouer the malice of the Subjects against *Harald* being an vsurping Tyrant, gaue great spurres to his victory: wherefore wee cannot iudge this a true Conquest: yet hath *England* beene conquered of the *Danes* a more Northerne people, and suffered many inconueniences of the *Scots*, but yet were neuer able to conquer them vterly, or bring them vnder subiection; although fewer in number, and neerer their Confines. Now for the second clause, that the people

ple of the Middle Region are more provident in preservation of Common-wealths is warranted out of the same grounds: for to this two things are necessary, to wit, *Armes* and *Counsell*: whence they used to paint *Pallas* armed; to signifie that not only *strength*, but *Counsell* was necessary for the establishment of Kingdomes. The *Southerne* people (as we haue shewed) being altogether addicted to contemplation, haue beene vnable either to defend themselues, or repell an enemy. On the other side the people of the *North* having *strength* sufficient to assault, for want of *prudence* and *counsell* could neuer long enjoy their Conquests, so that wee shall seldome read of any great Empire established of either. But the middle people hauing *strength* to subdue the *Southerne*, and policy enough to overcome the *strength* of the *North*, haue established many great and famous Empires. Here for an ample example wee may produce the State of the *Roman* Empire, which borrowed *Lawes* and discipline from the *Gracians*, nauricall Sciences from the *Sicilians* and *Punicks*, military discipline from their dayly exercise: and therefore was it no great wonder that in state and glory they surmounted all other Nations. On the other side wee finde many famous victories atchieued by the *Northerne* people, yet could they neuer leaue behind them any large Empire, but as easily lost as wonne their Kingdomes. Thus fared it with the *Goths*, the *Hannes*, the *Heruli*, and the *Vandals*, which with so many strong Armies invaded *Europe*, and *Asia*, who neuertheless for want of *Wisdome* and foresight, could not hold what they got, or settle therein any state of long continuance.

4 The extreame Regions in manners, actions, and customes, are cleane opposite, the one to the other. The middle partake of mixture of both.

That the manners of men depend on the naturall complexion and temper, is warranted as well by experience as approved testimony of our best Philosophers. For howsoever

grace

grace of education may make a change; yet this is extraordinary; and these raines once loosed men easily returne to their former disposition: How much the *Northerne* man differs from the *Southerne* in naturall constitution, wee haue formerly taught; out of which wee cannot but conclude, a great disparity in manners and customes: Yet to shew a more speciall and euident demonstration, wee will make a particular enumeration of such affections as are incident to the *Northerne & Southerne* man; & out of the comparison make our iudgement:

First therefore, it is manifest out of ancient and moderne obseruation, that the *Northerne* man hath beene taxed of too much leuity and inconstancy: The *Southerne* man contrariwise of too much peruerse stubbornesse, as well in opinion as affection. The reason of both wee haue before specified, to bee their naturall complexion: which in the former is inclined to sanguine, in the later to *Choller* *Adust*, and *melancholy*: whereof the one is the more subiect to change or impression, then the other. *Galen* deriuing all vertues from the humours of the body, makes *Choller* the mother of *prudence*, *melancholy* of *constancy*, *bloud* of *mirth*, *steame* of *mansuetude*: Out of the mixture of which humours, infinite variety ariseth. And because these humours are seldome equally, or proportionally combined, and tempered together; they become the sources of infinite vices: Which Inequality of temperament is rather found in the extreame regions: And therefore no maruaile if they are obserued, to haue beene subiect to greater vices then those of the middle region: For the mutability and leuerty of the *Northerne* Nations, wee can haue no greater argument then the change of religion: It is written of the *Ostrogothes* and *Visigothes*, that being expulsed by King *Attila*, they besought *Valens* that hee would grant them a dwelling place: conditionally promising, that they would submit themselves, as well to the lawes of the Empire, as to the Christian Religion. Which hauing obtained, they fled from their promise and perfidiously burnt the Emperour alieue. The *Goths*, as soone as they came into *Italy*, embraced the Christian Religion; but soone ranne into *Arianisme*: The people of *Greenland* according

ding to *Munsters* relation, being of a *wauering* disposition, soone lik't the *Christian Religion*, but soone relapsed to *Idolatry*. The *Turkes* being a kind of *Scythians*, as soone as they came into *Asia*, without any great constraint, embraced *Mahometanism*. The *Tartars* likewise, without any enforcement yeelded first to *Christianity*, and soone fell backe to the *Arabian rites*. The *Normans* comming into *France* although very rude and barbarous, reiecting *Gentilisme*, *Paganisme*, subscribed to the *Christians*. As soone or sooner the *Islanders* fell from *Idolatry* to the true *Religion*. The *Bohemians* and *Saxons* first cast off the *Roman* yoake; which were seconded by all *Saxonia*, the Cities of the *Balticke* sea, *Denmarke*, *Norway*, *Suedia*, *Heluetia*, and *Britanny*. The reuolt of these Nations from the *Roman* subiection, I cannot tearme *lenity* or *inconstancy* in their chiefe leaders and teachers: Being such as vpon long *deliberation* and mature *advice* attempted that, which they knew to bee most consonant to *truth* and *reason*: to whom without doubt God Almightyes hand was not wanting. But for the rude and *vulgar* people to be so soone wonne, and turned from one opinion to another, without longer *deliberation*, was argument of a *mutable* disposition: Sith there can bee no greater token of *Inconstancy* then to make an absolute change of *Religion* in all points in so short a space; whereas the Religions being so neerely affined, the one to the other, no man at first sight, out of *reason* and *discourse* would embrace or reiect all grounds together, but by degrees: No lesse argument of *lenity* in those Northerne people, is the distraction and diuision of them into so many sorts and *fallions* of *Religion*, as wee find now in *Germany*, *Belgia*, *Polonia*, and else-where, which no doubt at first proceeded from one or few beginnings. But on the contrary side, if wee looke on the *Africans* and *Southerne* people, we shall find them as *obstinate* and *peruerse* in standing to their owne propositions, as ready to tax the *Northerne* people of *lenity* and *Inconstancy*. For such hath been the settled constancy of these nations, as wel *Africans* as *Asiaticke*; that no meanes could be inuented to draw them from their opinion, but either *heavenly miracles*

or force of armes. Which constancy hath beene apparant, not onely in men but also in women and children: which made *Antiochus* euen mad when he by all cruelty tortured the Iewen Sonnes (as wee find in the booke of the *Maccabees*), yet was as farre from turning them from their Ceremony of forbearing the eating of Swines flesh, that both the mother inuited them, and the Children willingly submitted themselves to Martyrdome. Against this constancy *Mahomet*, when neither by fained miracles nor perswasion, he saw he could preuaile, betooke himselfe to Armes, for the establishment of his discipline which otherwise hee could no wayes haue brought to passe. And it is strange to see the Iewes at this day, which being a people dispersed ouer the face of the whole Earth, groaning vnder the seruile yoke of subiection, hauing no King, or supreme gouernour of their owne, haue so obstinately retained their religion, for these three thousand yeeres. What shall I speake of the *Mahumetans* in *Africke* and *Asia*; of the *Indians*, the *Chinois* and other Southerne people, which hauing once settled a platforme of Religious discipline, are unpregnable against all perswasion, mainly opposing themselves against the grounds of our Religion, hauing not so much as the principles of nature to support their owne. To let passe the ordinary commerce and trafficke, with Christian nations, which in so euident a case, might probably beget some fruits; the admired Industrie of the *Jesuites*, erecting their Colleges amongst them, might seeme to promise greater matters. But as I haue credibly beene enforced, by such as haue trauailed, as well into *Turkie* as *Africke* and *India*, the euent of their labours hath come so farre short of expectation, that they haue by their conference rather engendred a worse opinion of Christianity. Which though some may impute probably to their indirect meanes and superstitious rites, imposing on the conscience, what God neuer commanded, but rather forbad: Yet who so shall obserue the cunning and subtilty of these Sophisters will rather ascribe it to the peruerse and stubborne disposition of the people, vnapt to receiue any new impression: For else, who could imagine they could be so power-

full

full in peruerting and infecting others with their *Roman* superstition in these parts, hauing their consciences better enformed out of Gods Word, and their vnderstandings ordinarily better taught, in principles, and euery way more strongly fenced against temptation. As these Southerne nations alwaies boasted of their owne Constancy as a prime vertue, so ceased they not to vpbraide the Northerne man with inconstant leuitie. This the *Italians* obiekt to the *French* and *Germans* (as wee finde in *Tacitus*.) The *Greekes* heretofore to the *Italians*, the *Cretians* to the *Gracians*, the *Hebrewes* and *Agyptians* to the *Greekes* and *Cretians*; On the other side the other haue so much complained of their peruerse and setled superstitions. For to iudge indifferently of either, they are both vices declining from that golden mediocrity, which wee call Constancy. For the defect is leuitie, the excesse Pertinacy: and as it is very culpable in any man to turne with euery winde; so it is as great an indiscretion, to be so wedded to our owne opinions or affections as to turne on no occasion: Because all things vnder the sunne are subiect to change and alteration: And therefore it is the part of a wise man to accommodate himselfe vnto the obiekt, and not in a fond dreame to wrest all the world to his owne fancy. For a wise Sea-man will rather obey the storme then seeke his ruine, and when he cannot recouer the port, will turne to any other point for his owne preservation. I speake here onely of matters of state and policy, and not of religious actions, otherwise then concerne the externall rites and Ecclesiasticall discipline, the most part of which, by wise men haue been esteemed no other, then matters indifferent which may admit of change & alteration. But here some one might obiekt that the *French* of all Nations, haue been generally taxed of lightnesse and inconstancy, being notwithstanding in the middle region, more North then the *Africans*, yet more South then the *Germans* or *Scythians*; I cannot altogether excuse them of this Nationall blemish, yet with their countreyman *Bodin*, I hold it more fitly rearmed temerity then leuitie, being a people very quicke and agill, as well in speech, as action in so much as the executions

of matters with them many times are past, ere the *Spaniard* can enter into consolation: for as the *Spanish* counsell is ouer slow, and full of delayes, so is the *French* too heady and hasty: and as delay to the one, so rashnes to the other hath proved dangerous. The mediocrity betwixt both being a promptitude or alacrity in effecting matters, is to be esteemed as a vertue, which we find in the *Italians*, whose action is quicke enough, yet commonly grounded on sufficient deliberation: yet if we compare the two extremes, wee shall find the *Spanish* delayes to haue overcome the *French* hastinesse, being farre lesse subiect to errour, then the other.

Another difference betwixt the Northerne and Southerne man is discovered in the Affection of Anger and Reuenge. The *Northerne* man though quickly moued to anger, and very furious, prouokes his enemy to the open field, and after a little time is quickly pacified, forgetting the iniury. The *Southerne* man contrarywise is not so quickly iraged, but being once prouoked, pursueth his reuenge by secret stratagemes, rather then open fury, and will neuer or very hardly be drawne to reconciliation: which base and brutish disposition ariseth not so much out of their euill education (as some haue imagined) as out of melancholy ill tempered. A prooffe whereof wee haue in most men amongst vs, of a melancholy disposition, which according to our common prouerbe, threaten danger and hatred implacable: of this disposition were *Ajax* and *M. Coriolanus*, whereof the former for want of reuenge, in a distracted fury fell on the heards of cattle: the other would by no meanes be reconciled to his Countreymen, till he saw all their Cities in flames. Of the cruelty of the *Africans*, many histories haue giuen testimonies, especially *Leo Afer*, speaking of the *Carthaginian* dissention: and with later Writers most memorable is the story of miserable *Mulleasses*, deposed of his Crowne, his eyes burnt out, and his face disfigured, tending his complaint to the Emperour *Charles*. This cruelty hath no lesse been observed in the most Southerne *Americans*, with whom it is a custome to athe their children in the blood of their slaughtered enemies, o drinke their blood, and banquet with their car-

crises: And if we examine the originall of tortures and seuerer lawes, we shall find them originally deriued from the Southerne people, which the Northerne Man hath seldome vsed but vnwillingly in matters of horrible treason. And not without good reason haue our Lawes taken other courses for the conviction of malefactors in cases of felony and murder, then the extortion of confession by extreame tortures, a thing common with the *Italians*; because (as some of our Statists haue obserued) our Nation is by nature more apt to confession without torture, and so fearefull of torment, that they will more willingly be brought to the blocke or gallowes, then the racke: whereas the Southerne people by their melancholy temper more fearefull of death, and obstinate in their opinion, will yeeld rather to the greatest torture then confession.

Thirdly we shall find as great a disparity betwixt the Northerne and Southerne man in the sluttish carelesnesse of the one, and the cleanly neatnesse of the other. *Tacitus* reports of the old *Germani*, that they liued at home in their houses in fordid manner, almost naked, and that they vsed the same roomes as receptacles as well of their beasts as of themselves: which custome we shall not find much changed amongst some, if we read *Lipsius* speaking of the *Westphalians*, or haue so much patience elsewhere to make experiment. It is also reported that the *Scythians* whensoever they found themselves oppressed on the way, or in the wars by hunger or thirst, were wont to open a veine vnder their horses eares, and to sucke out their blood, and to banquet with the flesh, as we read of *Tamerlanes* Army on the like occasion: but the Southerne people are of a neat and cleanly disposition, abhorring all fordid and vncleanly action, vsing often bathings & washings, not only in sacred and Ecclesiasticall matters, but also in priuate. And therefore no wonder if (as *Xenophon* among the Ancients reports) that amongst the *Persians* it were accompted a very vnmanly thing to spit; or that amongst the *Abyssines* (as *Aluarez* writes) it should bee deemed a most hainous and flagitious crime, to drop any filth or spittle in any of their temples. An argument of this may be their extraordinary affection of neat &

dainty delicates, which (as *Athenens* relates) is most noted in the *Athenians* and *Egyptians*, by which means *M. Alexander* a luxurious spend-thrift, finding himselfe by *Cleopatra* surmounted, he smiled at his owne ambition in that kinde, and laughed at the *Romans* his owne Nation as ignorant and barbarous. Of the *Persian Theophrastus* writes, that by a certaine Law certaine great rewards were promised to such men as had inuented any new kinde of Delicates or pleasures, which is a great argument of the licentious affection of this Nation. A fourth difference may be discovered in the conuersion of the *Northerne* and *Southerne* Man. For the *Scythian* and *Northerne* man is naturally addicted to company and society, as may appeare by the communion of many men in one place in the fields, who amongst the ancients were termed *Nomades*, and are now called *Hordes*; in which manner the *Tartars* liue at this day: also it is well knowne how much the *German*, *Brittaines*, *Danes* are addicted to company, in so much as they can hardly liue long without companions. But the *Southerne* man being (as we haue proued) of a melancholy disposition chuseth rather to liue solitary, and to lurke in woods and deserts, then amongst people: Neere to which nature come the *Italians* and *Spaniards*, who affect rather a retired Gravity, then an open Society and conuerse, but at a distance, rather for formality of friendship, yet not the disparity in the disposition of these nations shall we find as well in the Languages they ordinarily vse, as the kinds of musick which they affect: for the former we may generally obserue in the *Northerne* Languages a rough collision of consonants and aspirations, as in the *German* and *Bohemian* Tongues. Neither is this obserued only in their native Tongues, but also in their vse of the *Latin* Tongue, in pronunciation of which they cannot but mixe rough aspirations, as I haue obserued oftentimes in the *Northerne German*, who commonly pronounce *firm* for *uirum*; *salua* for *uigil*; *Pipi* for *bibi*, with diuerse other of the like nature: as vnable they are on the other side to giue any soft aspiration his due sound, but commonly leaue it out altogether, or pronounce either the *vocales media* for *vocales tenues*, and *aspirata* for *media*, which

proceeds

proceedes altogether from the immoderate strength of heat and force of the spirits. But the *Southerne* people contrariwise wanting that degree of heat; in their pronounciation abstaine from these hard aspirations and collision of many consonants together, without vowels to mollify the harshness; as we find in the *Greece*, *Latin*, *Spanish*, and *Italian* tongues, which lyne neerer to the South. Also the *Turkish*, *Arabian*, and *Persian* tongues are by such as are experienced in them, sayd to bee sweet and elegant. Also it is to bee noted, that as often as the Colonies of the *North* haue invaded the *South*, although retaining the same foote steps and originall, haue notwithstanding much altered their pronounciation not onely through the mixture and impressiō of other languages, but also through the nature of the place; as wee find the *Gottish* tongue of the *Spaniards* to be changed to a smoother and sweeter pronounciation, then that which is retained in *Scythia*. I speake not of the *Latin* mixture, but of the meere *Gottish* words, which wee shall perceiue mollified with more vowels; and set to a sweeter termination. The like may be obserued in the *Hebrew* tongue; which (as *Iosephus Abudachnon*, sometimes, a Reader in this Vniuersity obserued) to the eare sounded far sweeter in the *Arabian*, *Turkish*, and *Persian* dialects then its owne originall; not that it is in them more perfect (which were impiety to beleene) but because men in pronouncing of it language preferring pleasure before *significancy*, haue mollified it, with soft vowels and aspirations, rather to serue the eare then vnderstanding. No lesse affecation shall wee find of diuerse fortes of musicke, fostering with diuers dispositions. The *Northerne* mans humour conlortes best with the *Phrygian* measure, a loud and stirring harmony. The *Southerne* man hauing his spirits more mollified affects the *Lydian*. The people of the middle region, are most of all delighted with the *Doricke*, a musicke heretofore vsed in sacred exercises. They who know these measures exactly, and which is agreeable to this or that mans fancy, will giue a probable guess vnto his naturall disposition. To runne ouer all the differences in manners and customes of the *Northerne* and *Southerne* nati-

ons were a matter infinite; wherefore it shall suffice to wrap up all in generall recapitulation. If wee compare the *Northern* man with the *Southerne*, wee shall find the one white and red, the other blacke or tawney; the one big-boned, the other small and dwarfish; the one strong, but easie to be deceived; the other weake, but witty and circumspect. The one given much to wine, the other exceeding sober; the one neglecting both himselfe and others, the other carefull and ceremonious. The one rustically arrogant, the other high minded; the one prodigall, the other parsimonious. The one temperate, the other lecherous; the one a house, the other neat and handsome; the one plaine and simple, the other craftie; the one a Souldier, the other a Priest; the one a Workman, the other a Philosopher; the one standing on the strength of his hands; the other of his wit.

Out of the mixture of these extremes, it is no difficult matter to draw the disposition of the middle Nations. For finding the two extreme nations of the *North* and the *South* to be not onely diverse, but for the most part opposite one to the other, in disposition and manners; it were very rational to iudge the middle to have a mixture of both, which observation wee will proue. For if wee compare the middle region with either the extremes, we shall find no such apparent diversity, as betwixt the extremes themselves. Here *Monsieur Badius* dreames of a golden mediocrity to magnifie his owne Countrey, which hee finds in his middle region. For sithence both these extremes challenge an extremity of disposition, hee imagines this middle tract onely reserved for vertue and temperance. But if hee iustly weigh all in the ballance of impartiall iudgement, he shall finde no such advantage. For first out of his owne grounds, to which wee have hitherto assented, he ascribes to the extreme nations an eminency both of vice and vertue. Then cannot the middle challenge these qualities other wise then remitted, and of lesse force. If therefore he would haue their inclination to vice more moderated, and corrected; he must also confesse their disposition to virtuous actions to be of lesse validity. Against these middle nations

ons are to bee accompted either directly situate betwixt both the extreames, or more inclining to the one then the other: For these directly in the middle, wee must imagine them to partake of both dispositions, as well to vice as to vertue, borrowing from either extreame as well good as bad. Here therefore can bee found no disadvantage: For if they will boast of the vertues of either, they must likewise be ashamed of either vices: If they plead a moderation of the former, they must loose so much reputation in the later. For these which more neerely incline to the one then the other, it will bee apparant that as they approach the one in one quality, so they are farther off in another: as if they approach neerer in contemplatiue wit to the *Southerne* people, so will they come so farre short of the *Northerne* valour. For by how much more they come neere the vertue of the one, so much come they short of the others Affections. The like may bee iudged of their Imperfections; so weighing reason with reason wee shall find no such inequality and disproportion to magnifie the one, or vpbraide the other: for that Almighty Creatour of all things is wont to distribute his blessings in proportion: and Nature his soueraigne hand-maide triumphes in nothing more then variety. Thus haue we spoken as farre as history and obseruation can iustifie, of the lawes, customes, and manners of the Extreame and middle Nations, in which we haue chiefly tied our discourse to the *Northerne* and *Southerne* people in this Hemisphere, hauing few histories to leade vs to the consideration of the other opposite on the *Southerne* Hemisphere: yet the causes being like, we may out of the former bee able to giue a iudgement of the later.

8. Hitherto haue we treated of the people of the *Northerne* and *Southerne* Hemispheres; with the speciall subdiuision of each into *Extreame* or *middle*: It now remains that wee speake of the diuision of Inhabitants
 accor-

according to the *Longitude*.

9 According to the *Longitude*, Inhabitants are either in the *Easterne Hemisphere*, or *Western*. Those I tearme of the *Easterne* which liue betwixt the *Canaries* and the *Molucco* Ilands on this side: The *Western* those which dwell betwixt those two on the other.

These two Hemispheres of the Earth haue by some beene called the *Old* and *New-world*; because the former containing *Europe*, *Asia*, and *Africke*, hath been knowne to the ancients as the portions of *Noahs* three Sonnes, *Shem*, *Ham*, and *Japhet*, whereof (as the Scriptures testifie) *Shem* had *Asia*, *Japhet* *Europa*, and *Ham* *Africa*. The other containing *America* the *South-continent*, and some other *Ilands*, haue beene since discovered. Of the comparison of the Inhabitants of these two Hemispheres we will insert this Theoreme.

The people of the *Easterne Hemisphere* in *Science*, *Religion*, *Ciuility*, *Magnificence*, and almost euerything else, are farre superiour to the Inhabitants of the *Western*.

For demonstration of this point wee need not spend much time; first, it is manifest that this Hemisphere was peopled a long time before the other, which is a probable argument of their culture and ciuility: because all these matters haue commonly their growth & perfection with Time, the mother of all perfection. That this part was peopled a long time before the other, is most credible: for it is plaine out of the Holy Scriptures, that the first off-spring of mankind was in *Asia*; whence it could not disperse it selfe into *America* and other parts of the

the Earth, till such time as their populous growth had required larger bounds. The passage from *Asia* into *America* without doubt had been performed either by sea or land. By Sea it was improbable they should adventure in that infancy of the World, when the Art of Navigation was in her swathing bands, and neither the Chart or Compasse as yet inuented. If by land they made their passage, it was doubtlesse through the North of *Asia*, supposing *America* with *Asia* to bee one Continent. But this people comming out of a pleasant and temperate Countrey, would without question first attempt the places of the like quality, as most pleasing their eye, and fitting their disposition, before they would inforce their passage to the Icy and frozen Climates of the North, which can only bee beholding to necessity for habitation. Hence without doubt it came to passe, that those Nations wandring farre from their first fountaine, and leauing no sufficient monument to instruct their posterity in their first originall, came short of the other, as well in reuealed as acquired knowledge. In reuealed knowledge, either sought in Holy Scriptures, or Traditions, they could not but come short; as being most distant from the first head and fountaine where it was to be found in greatest perfection. In Acquired knowledge gotten by industry and experience they could not come so farre as the other, because all such knowledge hauing its beginning from obseruation, and its growth with age, could not bee brought to that perfection amongst them, who came more lately to bee a people, and scarce euer endowed with any settled gouernment: but whatsoeuer the causes may bee thought of this diuersity betwixt the people of the Westerne and Easterne Hemisphære, certaine I am that the effect it selfe is most apparant. Of the happy endowments of *Europe*, *Asia*, and a good part of *Africke*, both in *Arts* liberall and mechanickall, *state*, *policy*, *magnificence*, and *Religion*, we haue often spoken, and neede make no repetition. To this if we compare *America*, being (as it were) the only portion of this Hemisphære, we shall amongst them find few or no *Arts* either inuented or taught, the vse of letters scarce euer knowne; *state* and *magnificence* little regarded, and the

Light

Light of Christian Religion scarce ever seene; or at least through the dimme clouds of Roman superstition. Hee that would know more in this matter, let him read *Peter Martyr*, *Cornejius*, *Acosta*, and others, of the naturall disposition of the people of *America*.

10 The Inhabitants of such Hemispheres are againe subdivided into the *Easterne* and *Westerne*: the *Westerne* in the *Easterne* Hemisphere, are they who liue neerer the *Canaries*: the *Easterne* are such as are situate towards the *Moluccoes*: to which those other in the *Westerne* Hemisphere are correspondent.

1 The *Westerne* people haue been observed to be more happy and able in martiall discipline: the *Easterne* in witty contemplation, and speculative Sciences.

There is no small affinity (as wee haue before touched) betwixt the *West* and the *North*, as betwixt the *East* and the *South*; as well in the temperament of the Aire, as the disposition of the Inhabitants: which cognation will appeare more fully by the prooffe and demonstration of this Theoreme. Of the strength and valour of the *Westerne* people, many records giue euidence; we read of innumerable Colonies of the *Celts* a people situate on the *West* of *France*, sent into *Italy*, *Greece*, & *Asia*. But the *Italians* durst neuer inuade *France*, till such time as their Empire was at the height vnder *Cesar*, taking also advantage of the home-bred enmities of the Inhabitants among themselves, whence *Tully* the Orator tooke occasion to praise *Cesar* for subduing those Nations, and reducing them to the *Romans* obedience, whose strength the *Roman* Empire could hardly sustaine. The *Italians* haue oftentimes molested the

Graci-

Grecians; yet from them suffered little or small inconvenience; for the *Grecians* having with their Armes cut out a large way through *Asia*, scarce ever dared to come into *Italy* but once under the conduct of *Pyrrhus*, who being almost defeated of his Armie, was enforced to save himselfe by flight. In like sort *Xerxes*, who brought men enough into *Greece* to drye up the Rivers, was notwithstanding defeated by a few *Grecians* to his great dishonour. Wherefore *Caeso* had good reason to object to *Murana*, and *Caesar* to *Pompey*, that their wars were waged against the people of *Asia* in respect of others were (as it were) rather against Women then Men. This without doubt gave *Alexander* his greatest happines and victory, that he turned his Armes against the *Easterne* people, which were either altogether barbarous, wanting martiall discipline, or all over delicate, not able to resist such hardnes: whereas if he had opposed the *Westerne* people (by the censure of *Livy*) hee had at least failed of those many Conquests, if not purchased a fatall overthrow. The obseruation perhaps of which courageous valour in the *Westerne* people was the cause why the *Turkes* heretofore were wont to chuse their *Janisaries*, and chiefe men of warre out of the *Europeans*, accompting them more strong and able then the *Asiaticks*, being of temper more soft and delicate. To this accords *Iulian* in his booke against the *Christians*; the *Celtes* (saith he) are Bold & Adventurous: the *Greeks* and *Romans* both warlike and civill: the *Egyptians* more industrious and subtil, although weake and tender. The *Syrians* with great alacrity conforme themselves to discipline: And a little after hath these words: What shall I declare (saith hee) how courteous of liberty and impatient of servitude the *Germans* are, how quiet and tractable the *Syrians*, *Persians*, *Parthians*, and all the Nations situate towards the *East* and *South* parts of the World. *Tacitus* reports, that the *Barbarians* lying on the West of *Germany*, of all the *Germans* are the strongest and most valiant: which *Plutarch* also confirms in the life of *Marinus*, that the most warlike people of all *France* are these which are most *Westerne*. The like opinion had *Caesar* of the *Westerne Nations*: of all the people of *Europe* (saith hee)

the

the *Westerne* people of the *Brittaines* and *Spaniards* are the strongest. Now as the *Westerne* people iustly challenge to themselves this prerogative of strength and valour, so must they yeeld to the *Easterne*, that of Religion and contemplation. To let passe the *Indians*, which a long time gone, were enriched with knowledge, if we belieue ancient writers, who can deny the *Hebrewes*, *Chaldeans*, *Syrians*, *Egyptians*, *Arabians*, and others of the *East* their iust trophies of learning and contemplation, which they haue erected to after ages? From these fountaines haue the *Greekes* and *Latins* deriued those large streames, wherewith they haue (as it were) watered all *Europe*. It is written, *That there came wise men from the East to worship Christ*; which must needs bee vnderstood of *Chaldæa* or the places neere adioyning, where the *Magi* or *Wise-men* were had in great reputation. If any object the decay both of *Learning* and *Religion* at this day, in the easterne parts of the world; Wee answer that this in most parts is merely *Accidental*, caused by the hostile inuasion of the *usurping Turkes*, which professe themselves to bee vtter enemies to *Learning* and the true *Religion*. To which, wee may adde the ignorance of the Christian Religion in many places, which is the greatest ground of solide knowledge. For amongst all religions in the world; there is none which giueth more way to learning then the Christian: Whereas some others altogether forbid the studie of such matters; yet is not this inclination so absurde in the *Easterne* people, but that euery-where some markes and footesteps will discover their disposition. For in the *East* shall wee find no small number of Christian Churches and Monasteries, professing Christianity and other good learning. But to speake no more of the Christian Religion, which wee hold rather by Gods speciall grace, then nature: the superstitious deuotion of these heathen nations to their owne false religions, is a sufficient argument of their naturall inclination to religious exercises. How obstinately peruerse, Ceremonious, and superstitious the *Indians* are found in Idolatrous Religions, I haue often wondred to heare some traauylers reporte: Of the other Hemisphere comprehending

ding *America*. I haue as yet small euidence out of *History*, whereon to ground any certainty; all we can say shall be comprized in this Theoreme.

2. *The easterne part of the western Hemisphere was peopled before the westernne.*

This proposition seemes probably warranted, as well by reason as authority; for first, supposing as an infallible ground, that the first offspring of all nations was in *Asia*, towards the *East*; it must needs follow, that to people *America*, there should be a passage thereunto out of *Asia*; because *America* was a long time not inhabited ere it was discovered to the *Europeans*. This passage then, was either by Sea or Land: Were it by sea, the first part whereat they could arriue was the easternne side. If wee suppose it to be by land (as is most likely in those ancient times) yet was it most probable it should bee on the *North-east* side from the *Pole*, because it is found by observation that on the *North-west* side it is divided from *Asia* by streites, then must they first touch on the Easternne part. To this we may adde the experience of the *Castilians* and *Portugalls* (who first discovered this part) who affirme that the people dwelling on that side, haue beene obserued to surpass the westernne by farre in ciuility of manners, knowledge, and such endowments, which may bee an argument of the antiquity of their plantation.

C H A P. XV.



The second diuersity of disposition of inhabitants ariseth from the diuerse nature of the *Soile*: Here lowre distinctions of Nations are remar-

remarkeable. 1. Of the Inhabitants of the Mountaines and plaine-Countreyes. 2. Of marsh and dry. 3. Of windy and quiet. 4. Of sea-borders and land-people.

That mens dispositions are diuersly varied according to the temper of the soile, euery mans owne experience may easily enforme him; for to reserve particular instances to their proper places, it is most manifest that all the vitall operations of the *soule* depends as well vpon the *corporeall* and *organicall* parts, as the *spirits*; which being diuersely affected by the qualities of the *Aire*, and *Earth* must needs vary and suffer a change. Plaine and euident disparity is found: first betwixt two nations situate in the same *Parallell* or *climate* in respect of the heauens. Secondly, betwixt two men borne in seuerall *Countreyes* lining together for some time, in the same region. Thirdly, of one and the *selfe-same man* living at diuers times in diuers regions. Fourthly, of a man living in the same *Countrey* at diuers seasons and times; all which being heretofore demonstrated will declare vnto vs the great *Sympathy*, and *operation* the *Aire* and his diuers qualities, hath with, and on our corporeall *spirits* and *organs*. But the temperament of the *Aire* (as we haue formerly shewed) depends on the temperature of the soile: whence it must needs follow that the naturall disposition of men should bee varied somewhat in respect of the *soile*. This disposition of the *soile* being manifold, wee haue reduced onely to three heads: leauing other curiosities to such, as haue more leasure: What wee iudge in this, shall bee declared in these Theoremes.

1. Mountaine people are for the most part more stout, warlike and generous then those of plaine Countreyes: yet lesse tractable to gouernment.

Of the warlike disposition of the *mountainists* and their strange

strange *Impatience to subiection*, many Histories giue testimony. Geographers repor, that setting aside the people of the *North* (to whom for *strength and valour* wee haue giuen the palme,) the Inhabitants of the mountaine *Atlas* are great and strong, out of whom the Kings of *Numidia* and *Mauritania* in time of warre are wont to leny their forces. And it is worthy admiration to consider the mountaine people of *Arabia*, who could neuer be drawne to yeeld to subiection, but being fortified not somuch by the benefit of the place (as some might happily imagine) but rather by naturall strength and valour, haue alwaies liued in liberty. To whom (as is reported) the *Turkes* giue a yeerely stipend to keepe them off from inuading the Territories of *Palestine* and *Damascus*. Of the *Marisians* the ancient inhabitants of the *Appenine mountaines* in *Italy*, the *Romans* were wont so well to conceiue, that it grew into a prouerbe: *Sine Maris triumphasse nominam*. *Gostane*, when he went about to inuade the kingdome of *Succia*, chose his legions of souldiers, out of the *Dalecarly*, who inhabite the *Succian mountaines*. But amongst all, no nation hath purchased a greater opinion and reputation then the *Heluctians*, liuing amongst the *Alpes*. These men are originally descended from the *Succians*, which for *valour*, haue so farre approued themselves, that they haue notonely kept themselves free from forraigne iurisdiction, but haue often deliuered their neighbouring countries from slavery and oppression. Against the house *Austria* they haue not once displaid their banners, and triumphed in their overthrow. A great part of *Germany* hath smarted vnder their valour; and such an honorable opinion haue they wonne, that they are accompted (as it were) the *Censors* and *moderators* to decide controuersies in matters of state and kingdomes. *Cicero* giues grrat commendations of strength to the *Ligurians* inhabiting the *mountaines*: It is well knowne how long and tedious warres the mountaine *Cilicians* and *Acercauneans* had with the *Turkes*: how long with small damage they endured affront, and droue them back. Here we might add the examples of the *Biscanes* and *Cantabrians* in *Spaine*, who vn-

der the conduct of *Pelagius* their King, withstood the *Saracens*, and preserved both their *language* and *religion*. The like ought to be spoken of the *Welsh* & *Cornish* people amongst vs, as of the *Scottish Highlander*: all which liuing in *mountainous countries* haue withstood the violence of forraigners, and for many y.ares preserved their owne liberty. And howsoeuer it may be objected that the aduantage of the place gaue them courage, yet can wee not deny their disposition due commendation; hauing not only thus for a time protected their owne rights, but made many hostile inuasions on their enemies. Hence *Bodin* would make a certaine *Harmony* betwixt the *mountaine* people, and the *Northerne*, esteeming the inhabitants of the *Alpes*, the *Pyraneans*, the *Acrocerauniij* the inhabitants of *Hemus*, *Carpathus*, *Olympus*, *Taurus*, *Stella*, *Caucasus*, *Imeus*, with diuerse others of the same nature, albeit situate in the *temperate* part, to bee accompted *northerne* people: as also farther towards the *South*, the inhabitants of *Ailas*, of the *Arabian mountaines*, of *Pirus*, and *Seraleona*; are (as it were) by him excepted from the *Southerne* inhabitants, in regard of their *high* and *mountanous* situation; which recompenseth the other, and challengeth asmuch cold, as by the heauens it should seeme to receiue heat. This conceit of a Monsieur *Bodin*, I admit without any great contradiction, were he not ouer peremptorie in ouermuch censuring all *mountanous* people of *blockishnesse* and *barbarisme*, against the opinion of *Auerroes* a great writer; who finding these people neerer *heauen* suspected in them a more *heauenly* nature. Neither want their many reasons, drawne from *nature* and *experiment*, to proue *mountanous* people, to bee more pregnant in *wit* and *guifts* of *understanding* then others, inhabiting *low* and *plaine* Countries. For howsoeuer *wit* and *valour* are many times diuided, as wee haue shewed in the *northerne* and *southerne* people, yet were they neuer so much at variance, but they would sometimes meete. First therefore what can speake more, for the witty temper of the *mountaine* people, then their *cleare* and *subtile Aire* being farre more purged and rarified, then that in *low* countries: For
 holding.

holding the *vitall spirits* to bee the chiefeſt instruments in the ſoules operation, no man can deny but they ſympathize, eſpecially with the *aire* their chiefeſt foment. Euery man may by experience finde his *intellectuall* operations more vigorous in a *cleare* day, and on the contrary moſt dull and heauy when the *aire* is any way affected with foggy vapours. What wee finde in our ſelues in the ſame place at diuerſe ſeaſons, may we much more expect of places, diuerſely affected in *conſtitution*. A ſecond reaſon for the prooſe of our aſſertion, may bee drawne from the *thinne* and *ſpare diet*, in reſpect of thoſe others. For people liuing on *plaines*, haue commonly all commodities in ſuch plenty, that they are much ſubiect to *ſurfeiting* and *luxurie*, the greateſt *enemy* and vnderminer of all *intellectuall* operations. For a *fat-belly* commonly begets a *groſſe head*, and a *leanne braine*: But want and ſcarcity the mother of frugality, inuites the mountaine dwellers to a more ſparing and whoſome diet. Neither growes this conuenience onely out of the ſcarcity of viandes, but alſo out of the nature of the diet. *Birds*, *Fowles* and *Beaſts*, which are bred vpon *higher* places, are eſteemed of a more cleanly and wholeſome feeding, then others liuing in *fennes* and foggy places: And how farre the quality of our *diet* preuailes in the alteration of our *organs* and *diſpoſitions*; euery naturaliſt will eaſily reſolue vs. A third reaſon may bee drawne from the *cold Aire* of theſe mountanous regions, which by an *Antiperiſtaſis* keepes in, and ſtrengthens the internall heat, the chiefeſt instrument in *naturall* and *vitall* operations. For who perceiues not his vitall, and by conſequence his intellectuall parts, in cold froſty weather to be more ſtrong and vigorous, then in hot and ſoultry ſeaſons, wherein the ſpirits are more diffuſed and weakened. This diſparity in the ſame region, at diuerſe times, in regard of the diſpoſition of the *aire*, may eaſily declare the diſparity of diuerſe Regions, being in this ſort diuerſely affected. A fourth reaſon may bee taken from the cuſtomary *hardneſſe*, whereunto ſuch people inure themſelues from their infancy; which (as *Hnartus* proues) begets a better temper of the braine, in regard of the wit and vnder-

standing; which wee happen to finde cleane otherwise with them, who haue accustomed themselves to delicatenesse. These reasons perhaps would seeme onely probable, and of no great moment, were they not strengthened with *forraigne* and *Domestike* obseruation. Haue not the *Heluetians* situate amongst the mountaines, giuen sufficient testimony; especially in the infancy of our *Reformation*? Haue not the *Suenians* and *Silesians* shewed themselves able enough, to wipe off the blot of a blockish disposition; yet hauing a situation wilde and mountainous? Had that great Doctour *Renclin* iudged well of the nature of such people, hee would not haue made it so great a wonder as hee did, that wilde *Suenia* should produce such learned Men. Forraigne influences elsewhere wherein all histories abound, I forbear to relate; desirous rather to bee accompted deficient then tedious. Should I draw home to my natieue *Westerne* Confines, to which I owe my breath, I should perhaps by some be taxed of partiality or affectation. Should I mention our ancient *Brittaines*, inhabiting the Mountainous Countrey of *Wales*, or the greater part of the *Scottish* Nation, inioying the like condition of life, and disposition of the Soyle; I might at once winne loue, and stirre vp enuy. Neuerthelesse, as a man by nature borne carelesse of *Detraction*, yet most respectiue of *Friendship*, I had rather venture my credit, then preiudice the truth: betwixt both which with mee the choice is easie. Mine owne Countrey of *Denon*, which duty commands me to make the first Instance, I had rather set on the stage of Enuy, then Dishonour. I am not of the opinion of the vaine-glorious *Greekes*; who boasting too much of their owne perfections, esteemed all Nations else *Barbarians*. Yet to checke Mr *Bodins* bold coniecture, out of which hee could finde but one *Anacharsis* in all *Scythia*; I will demonstrate that our mountainous Prouinces of *Denon* and *Cornwall*, haue not deserved so ill, as to bee so sharply censured for *Blockishnesse* or *Inciuitie*. Barten Countreies haue been known to nourish as good wits, as *Bodin*, *Aristippus* the *Philosopher*, *Callimachus* the *Poet*, *Eratosthenes* the *Mathematician*; haue not been ashamed to call *Cyrene* in *Egypte*

gypt their native Country, a Mountainous and Rocky Region. Neither can it be styled our reproach, but glory, to draw our off-spring from such an Aire which produceth wits as eminent as the Mountaines, approaching farre neerer to Heauen in Excellency, then the other in hight transcend the Valleyes. Wherein can any Prouince of Great *Brittaine* challenge precedency before vs? Should any deny vs the reputation of *Arts* and *Learning*: the pious Ghosts of *Jewell*, *Raynolds*, and *Hooker*, would rise vp in opposition; whom the World knowes so valiantly to haue displayed their Banners in defence of our Church and Religion. Should they exclude vs from the reputation of knowledge in State and Politicke affaires? who hath not acquainted himselfe with the name of *S^t William Perre* our famous Benefactor, whose desert chose him chiefe Secretary to three Princes of famous memory? Who hath not known or read of that prodigie of wit and fortune *S^t Walter Raleigh*, a man vnfortunate in nothing else but the greatnesse of his wit and aduancement? whose eminent worth was such, both in *Domesticke Policie*, *Forreigne Expeditions*, and *Discoveries*, *Arts* and *Literature*, both *Practicke* and *Contemplatiue*, which might seeme at once to conquerre both Example & Imitation. For valour and chiuallrous Designes by *Sea*; who reads not without admiration the acts of *S^t Francis Drake*, who thought the circuit of this Earthly Globe too little for his generous and magnanimous Ambition? Of *S^t Richard Grenuill*, who vndertaking with so great a disadvantage, so strong an Enemy; yet with an vndaunted Spirit made his Honour legible in the wounds of the proud *Spaniard*: and at last triumphed more in his owne honourable Death, then the other in his base conquest? Of *S^t Humfrey Gilbert*, *S^t Richard Hawkins*, *Dawies*, *Frabisher*, and *Captaine Parker*, with many others of worth, note, & estimation, whose names liue with the Ocean? In the Catalogue of able and worthy Land-Souldiers, whose eye would not at first, glance on my Lord *Belfast*, who lately deceased to the great griefe of his Countrey, because in such a time which most requires his assistance? *Courage*, & *Wisdom*. which are often at odds, and seldome meet, in him shooke

hands as friends, and challenged an equall share in his perfections. His wise managing of his affaires in *Ireland*, so well commends his owne *Loyalty*, and his Masters choice, that the whole Realme may truly be said for the most part to owe her present Peace to his industrie. Should I speake of Generous *Magnificence* and Favour of *Learning*, shewed by Heroicall Spirits in the generall Munificence extended to our whole *Vniuersity*; what Age or Place can gine a Paralell to renowned *Hodley*, whose name carries more perswasion then the tongue of the wisest Orator? His magnificent Bounty, which shewed itselfe so extraordinarily transcendent, as well in erection of his famous *Library*, which he (as another *Ptolomy*) so richly furnisht; as other munificent Largeesses, exhibited to our *English Athens*, was yet farther crowned by his wise choice, as proceeding from one, who being both a great *Scholler*, and a prudent *Statist*, knew as well how to direct as bestow his liberality. If *Founders* and *Benefactors* of priuate Colledges may find place in this Catalogue of Worthies, the sweet hime and receptacle of our *Westerne* wits can produce in honour of our Country a famous *Stapledon* Bishop of *Excester*; and worthy Founder of *Exon Colledge*: whose large bounty was afterward seconded (next to *Edm. Stafford* Bishop of *Salum*, a *Westerne* Man) by the pious charge and liberality of M^r *John Perryam*, *St. Iohn Acland*, & very lately by M^r *D^r Hakewill*, whose worthy Eacommium, (though vnwillingly) leaue out, lest I should seeme rather to flatter then commend his Worth. But what needes his my poore mention? His learned works published to the World, & his Pious Monument bestowed on our House, speake in silence more thē I can utter out of the highest pitch of Inuention. To all which I might adde M^r *Nicholas Wadham*, whose liberall hand hauing augmented the number of our Colledges with an absolute and compleat Foundation, haue left Muses enough to preferue his Name vnto eternity. Had I the lik priuiledge to mention the liuing as the dead, we should not finde wanting out of the ashes of these generous *Heroes*, of our *Deuonian* confines; many genuine and worthy *Sonnes* standing vp in their Fathers places, to shew the world

a suc-

a succession aswell of wits as times. There would appeare at once vpon the stage our famous Dr *Suiccliffe*, the worthy *Dean* of *Excester*, whose magnanimous endeaours, aswell in his learned conflicts with our pernicious *Romanists*, as in erecting a Colledge to oppose our sworne enemies, the *Iesuites*, will (no doubt) lengthen out the end of his declining age with Fame and immortality. I could offer to your admiration the Worth and Workes of our renowned *Rector*, Dr *Prideaux*, His Maiesties learned Professour of Diuinity in our Vniuersitie, in whom the Heroicall wits of *Jewell*, *Rainolds*, and *Hooker*, as vnited into one, seeme to triumph anew, and threaten a fatal blow to the *Babylonish Hierarchie*: Insomuch that hee may iustly challenge to himselfe that glory, which sometimes *Ouid* speaking of his owne country;

Mantua Virgilium laudet, Verona Catullum,

Romana gentis gloria dicar ego.

Mantua Virgill, Verone Catullus praise,

I will the glory of the *Romans* rayse.

Neither want the lawes of our Land, out of this one source, sufficient props to defend their Countries and the Kingdomes right. The admired sufficiency of *Iustice Doddridge*, testified to the world by so large a report, and expressed in his incomparable skill in the Lawes (besides his indowments of Artes and other Learning, seconded by the deserued Fame of Mr *Willam Noy*) can hardly scape my pen, being so deeply dipped in the middle of my Native Countrey. I care not what enuy I stirre vp in others, so my mother *Excester Colledge*, which sometimes cherished in her bosome these two worthy Darlings, and since found her curtesie returned back with interest, indulgently permit me this liberty.

Besides these choice floures cropt from our *Hesperian* garden, no question but many more would be found out aliuie or dead; whom fame, if not iniurious, cannot suffer to sleepe without deserued memory. I haue hitherto touched such eminent wits and persons, of whom for their profession sake the *Church* or *Common-wealth* haue greater reason to take especial notice. Many inferiour faculties are yet left where-

in our *Danow* hath displayed her abilities aswell as in the former, as in *Philosophers*, *Historians*, *Oratours* and *Poets*, the blazoning of whom to the life, especially the last, I had rather leaue to my worthy friend *Mr. W. Browne*; who as hee hath already honoured his countrie in his elegant and sweete *Pastoralls*; so questionles will easily bee intreated a litle farther to grace it, by drawing out the line of his *Potricke* *Auncelsters*, beginning in *Iosephus Iscanus*, and ending in himselfe. *Bodin* perhaps might oppose against vs the eminency of his *Parisian* territory, as some with vs the glory of our *Metropolis* and *Vniuersities*, disdainning all comparison: But to this it is not hard to shape an answer, 1. That a *Metropolis* or *Vniuersity* is to be imagined as a common receptacle of the most selected wits deriued rather from other places then the temperament of their owne Aire: Inasmuch as they may be said to owe their abilities, for the most part, to those to whom they owe their wealth. Neither can they challenge a greater interest in this glory, then our *Townsmen* heere in *Oxford* in the eminent gifts of our choicest *Schollers*; besides, that often happens in our great *Metropolitan* cities by the promiscuous concourse of diuerse dispositions; which is reported of *Nilus*, of diuerse sorts; that by vnnaturall commixture, they yearely beget new monsters: *Africa aliquid semper oportet noui*, 2. The ready meanes of *Aduancement* to high and eminent dignities in *Metropolitan* cities, which are commonly the ordinary seates of *Princes*, sets many a braine a worke although *Invisa Minerva*, to shew it selfe in publike: wherein hee hath the aduantage of *estimation* sooner then *sufficiency*: whereas many a towardly wit in places farre remote, neuer finds opportunity so propitious as to present him to popularity. I feare I shall be too tedious in this point, recalling to minde that I shall find few of my readers in this matter so affected as my selfe: yet should I not haue spunne out this theame so long, but to stop their mouthes who being sooner taught to speake then vnderstand, take aduantage of the rude *language* and plaine *attire* of our countrymen, admiring nothing more then

then themselves or the magnificent splendour of their owne habitation: As though all the witt in the world were annexed to their owne *schoolles*, and no flowres of science could grow in another garden: But a rude *dialect* being more indebted to *Custom* then *Nature*, is a small argument of a *blockish* disposition: and a homely outside may shroud more wit then the Silke-wormes industrie. I haue sometimes heard a rude speech in a *Frize* habite, expresse better sense then at other times a *scarlet Robe*: And a plaine Ycoman with a mattocke in his hand speake more to the purpose, then some Counsellours at the barre: And what other prorogatiue can such men appropriate to themselves aboue vs, but toyes and formalities, the Idols of *Gulls* and fooles, and the laughter of solide vnderstandings? But now after all this bickering with *M^r Bodin* to grow to a reconcilement, ere we part, wee will part stakes, and in the way of kindnesse giue him this one distinction, which I hope for quietnesse sake, he will accept. The naturall disposition of men and their gifts of vnderstanding and mentall faculties, arise either from their *naturall Temper*, or their *Discipline* and education: For the former I haue small reason to giue (as I haue said) the excellencie to the inhabitants of *plaine* and *low Countries*, rather then to the *mountaine* people: But in *discipline* and education I must confesse others commonly to be happier. 1. Because the *Fertility* and increase of the Earth inuiting men to such an Habitation, it must needs happen that such countries must bee more populous, and by consequence settle to themselves a better forme of *government*, then those which by reason of their barren soile are more neglected: 2. Because, most *Cities* and *Townes*, where are found the chiefest meanes of *Institution* of youth, are founded in *plaine Countries* and vallies. This *Perfection* that such regions boast of, is owed rather to *Institution* then *Nature*: Hence appeares the reason of the last clause of our Theoreme, to wit, why they should be lesse tractable to *government*: Because being (as it were) borne to too much *liberty*, they cannot so well inure themselves to *subiection*, as other who perhaps know no Condition but seruitude

of

of the mountainous people of Wales and *Scotland*, I cannot speake so much as intended: Both because I haue (I feare) tired already my readers patience, as also for that, being not so conuerfant in their Histories as mine owne, as an ill herald, I may chance to marshall all amisse. Who so list to reade the courage of our ancient *British* nation, hee shall find enough as well in the *Roman* Story, as our *English* Chronicles, to set them far enough aboue contempt, and place them an eye fore in the sight of enuy. But to leaue *Antiquities* & come to these times, we may easily amongst many other deserving men single out some, whose eminence so obuius to the eye of common obseruation, is able to dash *detraction* out of countenance. Who hath not heard not many yeeres since of Dr *Holland* the Kings Professour in our Vniuersity, and St *Roger Williams* a famous Coronell in the *French* and *Belgicke* warres? The Scholasticall *Learning* of the one, and the *mariall* prowesse of the other, was too well knowne to require a *Panegyricke*. Neither is *Wales* at this day below her selfe, but that she can triumph in two of the most Honourable and Generous *Peeres* of this Land, (to whose acceptance I owe these my poore labours) and the greatest *Administratour* of Iustice in our Courts: the two former, borne as well to hereditary vertue as greatnesse: the later aduanced no higher then his owne ability, whom the world knowes beyond my expression.

Scarce had I shut vp this tedious discourse, spent for the most part in defence of my native Countrey, but surprized with a deepe melancholy, I entred into a serious consideration of what I had too rashly spoken: I called my meditatiōs to a strict accompt, to examine what motiue should make me run so far beyond my intended purpose, to meet the Ambition of my Countrey or mine owne affection. The remembrance of some grieuances, seconded by mine inbred Nature, neuer taught to fawne on misprision, began to checke my officious pen, as guilty of too much weaknesse or adulation: when suddainly as in a vision there appeared vnto me my Mother *Oxford* vshe'd in by *Jfis* & all his *Muses*, who with a discontented countenance and harsh language, seemed to chide me in this manner:

Fond

Fond Sonne, who taught thy vnderferued praise,
 To crown thy country with these thanklesse Baies?
 What owest thou vnto that barren Earth
 But harsh reproach, sad cares, and haplesse Birth?
 What Legacie bequeath'd that soile to thee,
 But fruitlesse Hopes, and helpelesse Pouerty?
 What thou hast spoken of thy Westerne stronds,
 Will sooner plough vp mine, then cure thy wounds.
 Had thy neglected Muse without a Name,
 Spent halfe this industry to spinne my fame,
If had graced thee with Muses more
 Then euer tript on thy *Denonian* shore. (praise
 Which of these Worthies whom thou crown'st with
 Will ere thy wants relieue, or Fortunes raise?
 All the proud wooers of the Sisters Nine,
 Like Pilgrims come to worship at my shrine:
 And vauntest thou on *Demons* part their Names
 Who owe to me their worth, to her their shames?
 The prime and choice of all thy glorious flowres
 Cropt from my gardens and admired Bowres,
 Ought to returne the tribute of their praise
 Vnto my golden tongue and learned Layes:
 Nor had thy Westerne Confines euer found
 A Muse to sing of thy *Denonian* ground,
 Had not I touched her ambitious tongue
 First taught to chaunt amongst my learned throng.
 How oft hast thou drawne out thy precious time
 To tutour in my armes their youthly prime,
 Who like respectlesse and vntutour'd swaines,
 With losse and obloquie reward thy paines?
 Such are thy Darlings whom thou mak'st to ride
 In a triumphant carre by Honours side:
 As if proud *Honour* which can Kings command,
 As a poore seruant waited on thy hand.
 Thus thou vnwise giu'st immortality
 To those, whose base reproches follow thee.
 Had thine Ambition waited on my springs,

The

The breath of Princes, and the pow'r of Kings
 Had seconded thy Hopes, which now accuse
 To my disgrace and grieve thy haplesse Muse.
 Thy wants inforce thee still with me to stay,
 When each *Pedant* or makes or findes his way.
 To play and stake it at that lawlesse Game,
 Selling my Honours for to buy their shame:
 Vnhappy purchase ow'd to Charity,
 Bought by conniuece, sold to Periuery;
 By griping Brokers, since the fatall time
 That faire *Astrea* left thy thankelesse Clime.
 Thus thy admired *Demons* charity
 Sets strangers in her lappe and shuts out Thee.
 Hast thou been honour'd by my sacred Breath,
 'Mongst rude *Arcadians* thus to beg a Death?
 What greater glory can thy ashes haue,
 Then in my flowry groues to dig thy graue?
 Although the least among my learned sonnes,
 Thy fortunes told thee that I lou'd thee once,
 And so doe still: although my haplesse Baies
 Taught thy despair to spinne out carelesse dayes,
 And to compose thy discontented Head
 To slumber softly on the Muses Bed.
 Be rul'd by me my poore, yet loued Son, (done:
 Trust not their smiles whole wrongs haue thee vn-
 Thy faire Hopes grounded on thy place of birth,
 Will fly in *Atomes* or consume in Earth;
 Before within that Hemisphere of thine,
 Thy *Demons* *Sonne* on thee shall euer shine.
 Then trust vnto my bounty, turne thy sight
 From thy darke Confinnes to my golden light.
 All thy endowments owed to my wombe,
 Returne them back, and there erect thy tombe.
 If no *Mecenas* crowne thee with his Rayes,
 Teach thy content to sleepe out quiet dayes.
 Let Contemplation with transpiercing eyes,
 Mount thee a pitch beyond the starry skyes.

And

And there present thee that eternall glasse,
 Wherein the greatnesse of this wondrous masse,
 Shrinks to an *Atome*; where my *Aspurgabe*
 Shall shew thee starres beyond thy painted Globe:
 Where thou aloft as from a mountaine steepe,
 Shalt see the greatest men like Antes to receepe:
 Thy dayes shall minister thee choicest Theames,
 Which night shall render in delicious dreames;
 And thy severe Philosophy the whiles,
 In amorous kinde shall courte thee with her smiles.
 Or if thy nature with constraint, descends
 Below her owne delight, to practick endes;
 Rise with my morning *Phœbus*, slight the *West*,
 Till furrowed Age inuite thee to rest.
 And then perchance, thy Earth which seldom gaue,
 Thee Aire to breath; will lend thy Corps a graue.
 Soone the last trumpet will be heard to sound,
 And of thy load Ease the *Dunpaine* ground.
 Meane time if any gentle swaine come by,
 To view the marble where thy ashes ly,
 He may vpon that stone in few yeeres,
 Engrave an *Epitaph* with fretting teares,
 Then make mens frozen hearts with all his cries
 Drink in a drop from his distilling eyes:
 Yet will I promise thy neglected bones
 A firmer monument then *speachles* stones.
 And when I pine with age, and wits with rust,
 Seraphick Angels shall dresse me thy dust.
 And all good men acknowledge shall with me
 Thou lou'st thy Countrey, when she hateth thee.

This strange reproofe of an indulgent mother, I could not
 entertain without passion: In so much as without feare or
 wit, I aduencured in this sort, to answer her, in her owne
 language.

Unkinde world, I haue my former yeeres
 Somuch distressed thy heart, or filled my teares?

Thus

Thus to diuorce me from my place of birth,
 To be a stranger to my native Earth?
 Wilt thou expose him on thy common stage,
 To strue and struggle in an Iron age;
 Whose low ambition neuer learn'd of thee
 The curious Artes of thriving policy?
 Thy golden tongue from which my yonger dayes
 Suckt the sweet musick of thy learned layes,
 Was better taught thy office then my fate,
 To make me thine, yet most vnfortunate:
 Why was I fostred in thy learned schooles,
 To study with for the reward of fooles:
 That while I fate to heare the Muses sing,
 The *Winter* suddenly ore-took my *Spring*:
 Haue I so played the truant with my howres,
 Or with base riot stained thy sacred Bowres,
 Or as a Viper did I euer strue,
 To gnaw a passage through thy wombe to thrue:
 To pluck me thus from *Devils* brest, to try
 What thou canst doe when as thy dugges are dry?
 When my short thread of life is almost spunn,
 Thou biddst me rise vp with thy morning Sun;
 And like a *Heliotrope* adore the *East*,
 When my care-hastened Age arriues at *West*.
 Could I encounter (as I once did hope,)
 The God of learning in the *Horoscope*,
 My *Phabus* would auspicious lookes incline,
 On my hard fate, and discontents to shine:
 Now lodged in a luckles house, reiects
 My former suites, and frownes with sad aspects.
 Had I been borne when that eternall hand
 Wrapt the infant world in her first swaddling band,
 Before *Philosophy* was taught the way,
 To rock the cradle in which Nature lay,
 My Learning had been *Harbandry*: My Birth
 Had ow'd no toll but to the virgin Earth:
 Nor had I courted for these thirty yeeres?

Thy

Thy seuen proud minions with officious teares :
 To line had been my industry : no tongue
 Had taxt thy *honours*, guilty of my *wrongs*.
 Had I been *shepherd* on our *western* plaines,
 I might haue sung amongst those happy swaines ;
 Some shepheardesse hearing my melody,
 Might haue been charmed kind as charity,
 And taught me those sad minutes to reprize,
 Which I haue lost in studying how to thrine.
 Had I aduertur'd on the brinish fume,
 And sworne my selfe a stranger to my home
 Till time the *Haruest* reapt my *youth* did owe,
 And *Age* winter had spent all her snow
 Vpon my haire ; what worser could I haue,
 Then loose thy frownes to find a wished graue ?
 The *Scythian* hewne from *Caucasus* would aske
 Before my slaughter, why a needles taske
 Of *Trauaile* I should vndertake, to see
 Their Countreyes bounds and my sad misery ?
 But hearing my harsh bondage vnder thee,
 Would thine vnkindnesse hate and pittie me.
 To see thy Child far seuer'd from thy wombe
 The *Canniball* would make him selfe my tombe ;
 And till his owne were spent preserue my dust,
 In his deere vrne which thou hast sleightly lost.
 Canst thou neglected see his *Age* to freeze,
 Whose *youth* thou dandi'st on indulgent knees ?
 The fowle aspersions on my *Deuon* throwne,
 Thou mightst in right acknowledge for thine owne.
 Only this difference : to men wanting worth
 They sell preferments, and thou sends them forth.
 Canst thou be brib'd to honour with a kisse
 Thy guilded folly which deserues the hisse ?
 If thy foc'd wants and flattery conspire,
 To sell thy *Scarlet* to a worthles Squire,
 Or grace with *minuere* some *proselite*
 Who nere knew artes, or read the *Stragirite* ;

Yct

Yet should thy hand be frugall to preferue
 That stock for want of which thy sonnes may starue.
 Haue I seru'd out three *prentisships*, yet find
 Thy trade inferior to the humblest mind?
 And that outstrip by vnthrifts, which were sent
 Free with indentures ere their yeeres were spent?
 Then cease yee sisters of the *Thespian* springs,
Thalia burne thy books and breake thy strings,
 And mother make thy selfe a *second* Tombe
 For all thy offspring, and so shut thy wombe.
 Accuse not my iust anger, but the *cause*
Nature may vrge, but fury scornes her lawes.
 I sawn'd too long on Iustice: Sith that failes,
 Storme *Indignation* and blow vp my sailes;
 Ingenious choller arm'd with *Scorpions* stings
 Which whipp't on *Pesants*, and commandeth *Kings*,
 And giu't each milky soule a penne to write
 Though all the world turned a *parasite*;
 Temper my braines, thy bitterness infaile;
 Descend and dictate to my angry Muse.
 O pardon mother something checkes my spleene,
 And from thy face takes off my angry teene:
Reuolted Nature by the same degrees
 Goes and returnes; begges pardon on her knees:
 Thou art a *mirrour* by reflexion taught
 To faine defects, yet guilty art of naught.
 Thy *stewards* which by thy indulgence thrive
 Were they as iust, as thou art free to giue,
 We all might share a portion of that store,
 Which now thy sonnes deserue, thy *slaves* deuoure.
 Thy will is seldome measur'd by the *Law*,
 But *power*, whose greatnesse thy *Edicts* can awe,
 Slight's thy decrees: O would *Imperiall Rome*
 But once descend from his high Court above,
 To see thy innocent and maiden hands,
 By thine owne seruants basely shut in bands:
 These *Caterpillars* by his three-forkt *Rayes*,

Would

Would soone be scorch'd from off thy sacred Bayes;
 And thou restor'd vnto that pristine-hue,
 Which ancient times admir'd ours neuer knew.

All this time as in a fit of phrensy I haue spoken, I scarce know what my selfe: I feare mee too much, to, or of, my Countrey and Vniuersity, and too little for the present purpose. Now as one suddainly awaked out of sleep, no otherwise then in a dreame I remember the *occasion*: We haue all a *semel Insanimus*, and as a learned man of this Vniuersity seemes to maintaine, no man hath euer had the happinesse to be exempted from this imputation: And therefore I hope my Reader will pardon mee this once, if in such a generall concourse and conspiracy of mad men, I sometimes shew my selfe mad for company.

3 *Windy Regions produce men of wild and instable dispositions; but quiet regions more constant and curteous.*

The cause of this disparity is apparant; because a quiet mind, and apt for contemplation, cannot bee in such a man, as is perpetually tossed to and fro. For no man can well contemplate, except hee haue his mind purged and free from motion of the body; and it is noted by *Physiognomers* that *wiser* men are *slower* in the motion of their body and mind, whereas *mad* and *franticke* men are alwaies busied in body and mind. Hence a reason may be giuen why *Mariners* and *seamen* being continually tossed with the wind, are obserued to be more *barbarous*, *inhumane*, and *inconstant*. Another reason of this inconstancie and change, may bee drawne from the change of the *Aire*, caused by diuersity of winds; For wind being an exhalation affecting the aire and deriued from the Earth, must needs be diuerse in regard of the diuerse regions, from whence it bloweth. what cause soeuer be imagined, it is most certaine that people in windy regions haue been more warlike, though perhaps lesse humane: As in *Thracia*, *France*, *Circassia*, *Lybia*, *Portugall*, *Persia*, *Nornegia*, and *Polonia*: But in places in the same tract where the wind hath a lesse

domination we shall find them more tractable, but lesse valiant, as *Asyria*, *Asia minor*, *Italy* for the most part, and *Egypr*. In like manner the people of *Gallia Narbonensis*, *Aquitany*, and *Prouence* in *France*, are obscur'd to bee the most warlike, although situate in a more Southerne tract: Being daily interested, partly by the *Vulturnus*, partly by the *Corus*, which in these parts hath great power.

4 *Sea-borderers are generally more witty and adorned with more knowledge, then Inlanders, though subiect to greater vices.*

That *Artes*, *Ciuility*, and many *inventions* are owed to the sea, as the mother of encrease, seemes a matter out of question: For sith all nations haue not found out all *arts* and *inventions* it must follow necessarily, that they haue been propagated by traffick and commerce with forraigne nations: Whence it comes to passe many times that *Sea-borderers* by conference with *out-landish* people, haue gotten that knowledge and experience of things, for which others haue with great cost and danger aduentured on long and tedious traualles: Which I take to bee the reason why *Themistocles* would haue a Citie depending on the sea, and not as *Calius Rhodoginus* imagines, that hee might transisterre the power from the *Nobility*, to the *Ship-masters*. Thus we find *sciences* and *learning* to haue been deriued from the *Chaldeans* to the *Egyptians*, from the *Egyptians* to the *Phenicians*, from them to the *Grecians* and *Romans*: And in our dayes euery man can speake how much the industrie of the *Venetians*, *Spaniards*, *Hollanders*, *English*, and *Portugalls* haue effected in both *Indies*, in trafficking with them, deriuing together with their merchandize, much of their owne knowledge and religion. But as the *Ilanders* and *sea-bordering* people haue excelled the *Island* nations in skill and knowledge, so also in vices: Which stands with reason, whether we ascribe it to their naturall vice or condition of life, or education. For the greatest wits are commonly matched with the greatest vices, as depending on such a temper of the braine whose smallest change may beget madnesse: according

ding.

ding to that prouerbe, *Nullum magnum ingenium sine mixtura insanie.* Also Artes and Sciences turned to the worst vse, become more dangerous, then naked *simplicity*; for there is nothing to be feared more then *armed furie*. This might bee the cause why *Plato* in his booke *de Republica* warnes men to auoid the Sea, as the mother of wickednesse. Which is seconded by *Strabo*, who deriues the ofspring of *Robbery*, *pillage*, and *murder*, from the *Sea*: By which argument, the old *Athenians* were induced to draw the Inhabitants as much as they could from *Sea-trafficke* to *husbandry* and tillage of the Earth: Whence came at first (as some imagine) that fable of *Neptune* struing with *Minerva* for victory, against whom she preuailed, by shewing the iudges a *mandrakes* apple as an especiall rarity of the iand.

C H A P. XVI.

*Of the dispositions of Inhabitants according to their
Originall and Education.*

IN the third place there may be a diuersity of Inhabitants in disposition, either in respect of their *Ospring*, or their *Education*. In the former we are to consider the dispositions of nations so farre forth, as it depends from their first *stocke* and *originall*

By the first stocke and originall of nations, wee vnderstand not here either the first offspring from the loynes of *Adam*, or the second from *Noah*; because these two are common to

all nations of the world, and therefore cannot vary the severall dispositions of people: But the more *mediate* or speciall stocke whence they sprang, which is found to have no small power in the nature and temper of posterity. In this of-spring two things are chiefly remarkable; first, how people suffer an alteration in respect of their severall *Transplantations*: Secondly, in the *mixture* of colonies, both which we will shew in these Theoremes.

I Colonies transplanted from one region into another, far remote, retaine a long time their first disposition, though by little and little they decline and suffer alteration.

All *mutation* requires a certaine distance of time: Sixth motion according to *Aristotle* is in an instant, neither is it a small time can alter the naturall complexion of men: For as much as the children for the most part deriue their nature from their parents, and euery mans constitution is commonly radically grounded, and not easily subiect to externall change: Thus we see the Children of *Blackmores* being transplanted into *Europe* for diuerse descents to continue *black*: Yet so as they by little and little declining from their former hue, will in time become *white*; as the rest of the *European* Inhabitants: For otherwise it must needs follow, that *Scythia* should at this day breed many *Blackmores*, and *Ethiopia* many *white*; because no question can bee made, but that all nations almost of the world since the beginning haue suffered *mixture*. Wee reade that the *Gothes*, being a warlike people of the *North*, long after their first inuasion of *Spaine*, *France*, *Italy*, and other Territories of *Europe*, retained their owne disposition and nature, altogether disagreeing with the nations, amongst whom they liued: governing (as is the manner of *Northerne* Potentates) rather by *Strength* then *Policy*, better able to *winne* then *establish* an Empire. But in proceffe of time it came to passe, that putting off their harsh temper they grew into one nation with the native Inhabitants, as in *France* and

and *Italy*, or at least as in *Spain*, establishing a government of their owne, by little and little declined from their rudenesse to civility, turning their armes to *Arts*, their strength to *stratagemmes*, hauing of late yeeres by witty pollicy established a greater empire, then euer their Ancestours could atcheiue by multitudes of men, and strength of armes. And it is worth obseruation, that as these haue suffered a change of *Lawes*, *customes*, *government*, which they owe more to the nature of the *Climat* then to *Education*; so in their very language. For the language of the *Goths* heretofore, differed little from the language of the ancient *Germans*, which (as most *Northerne* languages) was very rough, consistting of many hard and harsh aspirations, with vnpleasant collition of many *consonants* together: But at this day is changed into a very elegant tongue pleasant to the eare, consistting of many *vowels* and the softest aspirations. Finally such haue beene the alterations of this people, that being heretofore farre *North* and branded with all the markes of *Northerne* rudenesse, they are now esteemed in the Catalogue of *Southerne Inhabitants*: Not in regard, as much of *place*, as *nature*. The like may wee obserue of the *Turkes* and *Tartars*, who spreading their empire from the *North* towards the *South*, a long time retained their rude barbarous *nature*, which they haue not at this day altogether cast off; yet so much hath time and place gained vpon their temper, that they are much mollified and farre more tractable to *humanity*, addicting themselves euery day more and more to the study of *arres* and *civility*: in so much that (as one obserues) had they not preserved their strict *discipline* in training vp their youth to *armes*, they had long since lost much of their large empire, and haue yeelded to the *Polonian* and *Musco- nite*. This change may we find not onely in *mankinde*, but also in *beasts* and *plants*, which being transported into other regions, though a long time retaining their natiue perfection, will notwithstanding in time by little and little degenerate: As I haue heard by relation of some of our *Virginian* colony in *America*: who finde a great alteration in our *Corne* and *Cattle*, translated thither. This might also bee obserued in the

Danes, Saxons, and Angles, comming into *Britanny*, who partly by the *Climate*, partly by *mixture* with them, by little and little deposed their disposition, and became more *ciuill*. The like may be spoken of the *Saxon-colonies* sent by *Charles* the great into *Belgia*, who since that time becomming more *ciuill* haue proued lesse warlike, loosing as much by the one, as they obtained by the other. This point I will no further prosecute, because I hold it sufficiently demonstrated out of that I haue spoken of the variety of naturall dispositions according to the heavenly *situation*, and the *seile*. For sith all nations came at first from one *originall*, we must needs ascribe this mutation to the places which they inhabite.

2. *The mixture of Colonies begets in the same nation a greater disparity and variety of the Inhabitants amongst themselves*

This proposition is by naturall consequence deduced from the former: Because all *Colonies* transplanted retaining some-what of their former nature, the *Mixture* must produce *variety*. First, because the *number* of people of any region by this is supposed to consist of more kinds of dispositions: Secondly, because the promiscuous *mixture* of these kinds being vnequally tempered, must according to their seuerall combinations produce people, as vnlike one to the other, as to the former. Hence a reason may bee giuen, why the Inhabitants of the *extreame* regions, either *North* or *South* are found to bee amongst themselves as well in *temper*, as in externall *face* and habite more like one to the other: whereas the *middle* partake of more variety. For the *Cimbrians*, *Danes*, and other *Scythians*, are for the most part of a *whitish* hue, with *flaxen*, and yellow *haire*; on the other side the *Ethiopians* for the most part are *blacke-haired* and *curled*. The *French*, *Germans*, and the *English*, admit of all variety, hauing some *white-haired*, some *black*, some *yellow*, some *tawny*, some *smooth* and some *curled-pates*. This diuersity the *Stoicks* would ascribe to the *phantasie*, or image conceiued in the minds of men. Whence they would giue a cause, why beasts commonly bring

bring forth yong, more like one the other then men; because (say they) wanting a *reasonable* soule they are not stirred vp as men with sundry cogitations, but onely with sense. So the *Scythian* and *Northerne* man being by nature more *simple*, and affecting those pleasures which are agreeable to nature, and lesse distracted by variety of thoughts, is found to beget children more like their parents then those of the *middleclimate*. This cause wee should admit probable enough, but for a reason vrged by *Bodin* and others, that in *Ethiopia*, where the people of all other is more *Acute*, and more *violent* in lust, they are most like one to the other. For 'euē all are found to be *small* of stature, *curle-pated*, *black-skinned*, *flat-nosed*, *smooth-skinned*, *great-lip'd*, *white-toothed*, *black-eyed*: Wherefore this infinite diuersity in the middle region, we cannot well ascribe to any other reason, then the manifold *intermixtion* and *combination* of both the *extreames*. Whence it comes to passe, that by how much more we wander from the *middle region*, so much the more shall wee finde the people amongst themselves: In so much as *Tacitus* spake of the *German*s, that amongst themselves they were very like in respect of other nations. This mixture in the *middle region* out of the *extreames*, may easily be shewed out of diuerse Colonies, which from the *extreames*, haue beene translated into the *middle region*, as the better place of habitation. For hither came the great and extraordinary armies of the *Scythians*, *Goths*, *Turkes* and *Tartars*; None besides the *Vandalls* passed into *Africke*, from whence they were in short time expelled. The *Arabians* and *Puniceans* called by the ancient *Saracens*, leading their Colonies into *Europe* and *Asia*, settled themselves in the *middle region*; None came into *Scythia*: for when they had invaded *Spaine*, *Italy* and *France*, they were in *France* altogether broken, and cut off: After which, *Spaine* and *Italy* found a meanes to free themselves from their bondage. Likewise the Colonies of the *Celtes* and *Romans*, endeauoured alwaies to settle themselves in the *middle Regions*, and neuer ventured as farre as *Scythia* Northward, or Southward as farre as *Ethiopia*: Whence the *middle* charged

with intermixture of both extreames beget a great diuersity. For we find by experience, that out of the mixture of diuerse kinds, diuerse *Formes* and *Natures* are ingendred : As of the *Mule*, *Leopard*, *Crocota*, *Lycisca*, and *Camelopardus* ; which being *mixt* Creatures are vnlike their Sires : So may we iudge of the various mixture of diuerse kinds of men. A *Mastiffe* or *Lycisca*, little differs from a *Wolfe*, because he was conceiued of a *Wolfe* and a *Dogge* ; So that a *Wolfe* is (as *Varro* noteth) nothing else then a *wilde Dogge*. But on the other side, a *Mule* from an *Asse* and a *Horse*, As a *Camelopardus* from a *Panthor* and a *Camell*, differ very much ; so that if people very neere in *Nature* be linckt together, they produce an of-spring very like themselves : But if two very vnlike in nature ; as an *Ethiopian* and a *Scythian* should match together, they must needs bring forth a birth very vnlike to themselves : like a *Personated man* brought vpon the stage by *Psolomans Philedophus*, who (as *Athenens* writes) was of two colours, on one side *white*, on the other *blacke*.

2 The second point whereby the disposition of people is varied, is *Education*. Education is the exercise of many people in religions, or morall discipline.

Amongst all externall causes of the change of dispositions, there is none greater then *Education*. For as a good nature is oftentimes corrupted with euill conuersation, so an ill disposition with good institution hath in some sort been corrected. The chiefe objects of discipline are *Religion* and *Morality* : Whereof we giue the chiefe prerogative to *Religion*, as that which more immediatly bindeth the *consciencs* of men, euen against nature. In the second place *Ciuility* ; whose end is worldly happinesse. How far each of these preuaile, shall bee shewed in these Theoremes.

1 Education hath great force in the alteration of naturall dispositions : yet so as by accident remitted

remitted, they soone returne to their former temper.

The force of *institution* hath been so great, that by some it hath been thought to equall, if not surmount *Nature*; whence they haue tearmed it a *second nature*: For as wee see all sortes of *Plantes* and *Hearbs* by good husbandry, to grow better, but left to themselves to grow wilde and barren; So shall wee find it, if not much more, in *mankind*; which though neuer so *Sauage* and *Barbarous*, haue by discipline been corrected and reformed, and though neuer so *Polite* and ciuill neglecting discipline, haue degenerated, and growne barbarous. For if the externall lineaments of the *body* may bee by art (as it were) wrought into another mould, much more may wee ascribe this to the habits and operations of the *mind*, being of a more agill nature, and apter to receiue impression. The ancients amongst the *French* (as *Bodin* testifies) deemed a long visage the most handsome: Whence the Midwiues endeouored to frame most faces to this fashion, as may bee seene in most ancient statues and images. In *India* (as wee also reade) a *great nose* and a *broad face* was most admitted: which caused their Midwiues to effect it as neere as they could in their tender infants. In like manner it hath been the endeaour and ambition of most teachers, and informers of youth, to frame the *wits* of their nouices to such disciplines and perfections, as in the same country found most honor & best acceptance. Hence it came to passe that *custome* preuailing beyond *nature*, many nations situate in a ruder climate, wanting that benefit of the *Heauens* which others plentifully inioye, haue surpassed them in *Artes*, *Sciences*, and many other *Endowments* of the minde. In so triuiall a matter wee will not roue farre for example. It is recorded by the ancients as well of the *Germans*, as of our owne nation, that they liued almost in the condition of *wilde beafts* in Woods and Defarts, feeding like swine on *heards* and *rootes*, without law or *discipline*: In so much as their *Bards* or learned men (as they deemed them) wanting the vse of *letters*, challenged their chieftest perfection in the composure
of

of certaine *rimes* of triuiall subjects to please the people. Their houses were caues, their *pallaces* brackes and thickets, their *tables* rockes (as one saith of them) *Antra lares, dumeta thoros, canacula rupes*. They were (as *Iustine* speakes of the infancy of the world) rather carefull to keepe their owne, then ambitious to conquer others; and more studious to preserve life then seek honour. Their onely law was nature, or some few customes preserved by tradition, not writing: Little differing from the present *Americans*, not yet reduced to civility. But *time* and *discipline* preuailing against *barbarisme*, they are (God be praised) reduced to such a height of civility, that they may (as it were) reade other mens wantes in their owne perfections, and measure other mens losse by their owne gaine. Insomuch as they seeme to haue robbed the *Asiaticks* of *humanitie*, the *Romans* of *militarie Discipline*, the *Hebrewes* of *Religion*, the *Grecians* of *Philosophie*, the *Egyptians* of *Geometry*, the *Phœnicians* of *Arithmetick*, the *Chaldeans* of *Astrologie*, and almost all the world of curious *Workmanship*. This their excellency hath bin so fortunate, as to set them in the enuy of other nations, who notwithstanding haue beene faine to borrow of their store. The *Italians* are censured by *Machiauell* the *Florentine* for sending for *Germans* to measure their land, chalenging to themselves the prerogatiue of *wit*, aboue other nations. Likewise *Pope Leo* dispatched his Embassador into *Germany* for *Mathematicians*, to rectifie the *calender*, as sometimes *Caesar* into *Egipt*. This force of discipline how great soeuer being for a time neglected, *nature* is notwithstanding found to returne to her owne corruption. A prime example of it we haue in the *Romans* and *Italians*, heeretofore for *Artes* and *Military* discipline carrying away the palme from the whole world: But now degenerated so much, as it may seeme the image of *basenesse*; submitting their neckes to the pride of an insulting *Prelate*, farre more abiect then the losse of their *libertie* vnder *Caesar*, or the *Gothish* vsurpation of *Alaricus*. The like effect of this neglect of discipline may we find in the *Hebrewes*, *Chaldeans*, *Phenicians*, *Egyptians*, *Grecians*, and *Indians*, who

who were sometimes admired for *learning* and *Eloquence*, and set in the highest top of perfection. Wherefore *Aristotle* had good reason in his first booke *de Cælo* to affirme, that *Artes* and *Sciences* with all nations had beene subiect to *ebbes* and *flomes*, sometimes *flourishing* in great perfection, and sometimes *languishing* and contemned. And to this and no other cause, can we ascribe the present *Ignorance* and *Barbarisme* of the *Americans*: Their descent being from *Noah* and his posterity, they could not at first but haue some forme of *discipline*, which afterwards being by long proceffe of time or incertainty of *tradition* neglected and obliterated, they fell backe into such wayes as their owne depraved nature dictated or the diuell maliciously suggested.

2 By Discipline nations become more wise and politicke in the preservations of states, yet lesse stout and couragious.

As *Discipline* hath been the chiefe cause of the establishment of all states, so hath it on the other side been occasion to *soften* and weaken the courage of many nations: For it hath beene many times scene, that such people who haue beene commended for *wir*, haue yeelded to such who are of a ruder disposition: as at this day the *Greeks* and *Macedons* to the *Turkes*, the ancient *Gauls* to the *French*, the *Egyptians* to the *Persians*, the *Chaldeans* to the *Saracens*. Hence some giue a reason why the *French* did innade and runne ouer *Italy* without controule vnder *Charles* the 5; because the *Italian* Princes at that time were giuen to *study* and *learning*; and it is obserued that the ancient *courage* of the *Turke* is much abated, since the time that they grew more ciuill and more strictly imbraced discipline. And this some thinke to haue giuen occasion to *Alexander* the great, to conquer the *Persian* Monarchie, the *Persians* hauing beene before reduced to ciuility, and lost their hardnesse. And we daily see by experience, that no men are more desperate and aduenturous, then those which are rude and barbarous; wanting all good *manners* and *education*. None more fearefull and many times more cowardlike then such.

such as are most *wise* and *politick*: an example of the former we haue in *Ajax*, of the other in *Ulysses*, wherevpon the wisest *leaders* and commanders haue not been esteemed the most valiant. A certaine English gentleman writing military observations affirms the *French nobility* to bee more valurous and coragious then the *English*: Because of the loosenesse of their *discipline* and the *strictnesse* of ours. But I will neither grant him the one or the other, neither can I auerre their *courage* to be greater, or our *discipline* stricter. If their valour bee more, it must needs follow their *virtue* is lesse out of this ground. But howsoeuer it be, I am sure that *Cesar* and *Tacitus* gave the cause of the great stature and courage of the *Germans* to be their *loosenesse* and *liberty*, which howbeit it bee not the sole cause, it must needs bee a great helpe. For wee plainly finde by experience that those countries which be most *mountainous* where is lesse discipline, are found to produce men for the most part, most *warlike*: Such as the *Switzers* in *Germany* and *Biscaynes* and *Aragonians* in *Spain*. Whence (as some obserue) such countries as are partly *Mountainous*, partly *plaine* are seldom at quiet, the one part willingly submitting themselves to gouernment, the other affecting warre and rebellion. Which hath been the cause of the troubles of *Naples*, and in *England* before *Henry the eighth's* time betwixt the *Welsh* and *English*. Why discipline should in this sort mollifie and weaken the courage of men, many causes may bee given. The first and greatest is *Religion*, then the which, there is no greater curbe to the courage: not meere of it selfe, but by accident; Because *Death* being the greatest hazard of a *souldier*, religion giues a more euident apprehension and sense of the *immortality* of the soule of man, and sets before the eye of his vnderstanding, as it were the images of *Hell-paines* and *Celestiall ioyes*, weighing in an equall scale the danger of the one, and the losse of the other. Whereas ignorant people wanting all sense of *religion* lightly esteeme of either, holding a temporall death the greatest danger. Whence grew the vsuall Prouerbe amongst profane *Ruffians*; that *conscience makes cowards*. But this (as I said) is meere-

ly accidentall : For as much as nothing spurres on a true resolution more then a *good conscience*, and a true touch of religion : witnesse the holy *Martyrs* of the *Church* of all ages, whose valour and constancy hath outgone all heathen presidents. But because souldiers for the most part, being a most dissolute kinde of people, hauing either a *false religion* which can suggest no setled resolution, or an ill conscience grounded vpon no assurance, *Religion* must needs beget in them a more fearefull disposition. Another cause may bee the severity of discipline, which especially in the training vp of youth, is mixed with a kind of slavery: without which our yonger years are very vntractable to tast the bitter roots of *knowledge*. This *fear* (as it were) stamped in our affections cannot but leaue behind it a continuall impression, which cannot suddenly bee razed out. Such as we find in vs of our *masters* and *teachers*, whose *friendship* we rather imbrace, then *familiarity*. A third reason, why discipline would weaken and mollifie a Nation, may be the delight which men reape in *Contemplatine* studies, and *morall* or *politicke* duties, whence followes an neglect of the other. For people of *knowledge* must needs finde a greater felicity in giftes of the minde, which is vsually seconded with a contempt of externall and military affaires. The last cause may bee the want of vse and practise of military affaires in most common-wealths; for many states well established continue a long time without warres, neither molesting their neighbours, nor dissenting amongst themselves; except very seldome, and that by a small army, without troubling the whole state: whence the generall practise being lesse knowne, becommes more fearefull. Notwithstanding, all this it were brutish to imagine *discipline* any way *unnecessary* or *hurtfull*, either to a *Captaine* or *Statesman*. For as much as it more strengthens the *wit* then abates the courage of a nation. Neither is it properly said to breake and weaken, but rather to temper and regulate our spirits. For it is not *valour*, but rather *rashnesse* or *fiercenesse*, which is not managed with *policy* and discretion. And although it hath sometimes beene attended with notable exploits, as that of *Alexander*
the

the great, of the *Gothes*, the *ancient Gaules* and many other. Yet shall we observe such conquests, to bee of small continuance: For what they atcheiued by *strength*, they lost for want of *policy*. So that it is well said by one: that *moderation* is the mother of *continuance*, to *States* and *Kingdomes*. Thus haue we run ouer (by Gods assistance) the chiefe *causes* of diuersity of *dispositions* of Nations: Wherein if any man will informe himselfe (as hee should) hee must compare one circumstance with another, and make his iudgement not from a *man* but a nation; and not censure any Nation out of *one* obseruation: For *practise* in *Art* cannot alwayes come home to *speculation*. So *experience* in this kinde will oftentimes crosse the most generall *rules* wee can imagine. Tis enough to iudge as wee finde, and walke where the way is open; If any man will desire more curiosity, hee may spend more labour to lesse purpose. Let euery man by beholding the *nationall vices* of other men, praise Almighty God for his owne happinesse: and by seeing their vices, learne to correct his owne vices. So should our trauaile in this Terrestriall-Globe bee our direct way to Heauen: And that eternall guide should conduct vs which can neuer erre: To whom be ascribed all Glory, Prayse, and Power, for euermore.

Deo triuni Laus in eternum.

F I N I S.



